# THE TRANSACTIONS OF THE BOMBAY GEOGRAPHICAL SOCIETY.

FROM DECEMBER 1854 TO MARCH 1856.

(NEW ISSUE.)

EDITED BY THE SECRETARY.

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# PREFACE.




The present number of the Transactions of the Bombay Geographical Society has been nearly a twelve month later in its appearance than was intended. The retardation being due partly to the difficulty of getting a large number of the papers prepared for the press, and in part to the delay occasioned in passing these through the printer's hands, at a time when the somewhat limited typographical resources of Bombay were taxed with more than usual severity.—And meanwhile matter which must be deferred, has accumulated, well nigh sufficient to put another number to press.

A considerable alteration in the form of publication has just been made, and the number now issued may be considered the first of a new series. From the irregularity of publication, and the long intervals which ensue betwixt consecutive issues, it has been deemed expedient to make each successive number complete in itself as if a separate volume, no matter how insignificant in its size. For convenience of reference, each will be furnished with a Title Page and Table of Contents at the beginning, andan Alphabetical Index at the conclusion. In India, Scientific notices of much interest, though it may be of insignificant volume, are constantly making their appearance in the Newspapers, where in the course of a few months or years they are altogether lost sight

of. To preserve these from oblivion, a selection of them has been published in the form of an Appendix,—on the plan pursued by many of the scientific periodicals at home, and this is in future intended to be carried out.

Since the earlier of these pages passed through the press, the discovery of the Ship *Resolute*, adverted to as abandoned in the paper on Arctic Discovery, p. 44, has been recovered under the following singular circumstances :—

"Her Majesty's ship *Resolute* has been picked up in Davis' Straits. The drifting of the *Resolute* is the most extraordinary instance of drifting on record. Loosened by nature from its icy prison in the pack ice off Cockburn island, the island next akin to Melville island, the land on which the *cache* called Parry Sandstone, the post-office of the North Pole, exists, the *Resolute* makes its own way into Davis' Straits. By what passage? This must ever remain a mystery. The most likely route is that of Barrow Strait, but Sir E. Parry has placed it on record, and it remains uncontradicted, that there is no current in that strait. Has the *Resolute*, then, drifted into the Atlantic through Jones' Sound or Smith's Sound? Has it passed through that magnificent sea of 3,000 square miles, just discovered by Dr. Kane, the American? What an interesting tale the *Resolute* could tell us if a single human being had been on board. It was from the Parry Sandstone help was sent to the discoverer of the North-west passage, he himself having given up all hope, not only of reward for his great discovery, but of his own natural existence. It was from this well-known *cache*—aye, and from this very ship, that Lieut. Bedford Pim sallied forth on his arduous journey, unparalleled in arctic travelling, at the low temperature it was undertaken, and thus saved the gallant discoverer of the North-west passage from the death that awaited him."

Captain McClure about this time received the honour of Knighthood, and no man ever better deserved it.

The American expedition under Lieut. Kane, which had not been heard of when the narrative was prepared, returned in safety to New York in December 1855. They had heard no tidings, and met with no traces of

# PROCEEDINGS

OF THE

# BOMBAY GEOGRAPHICAL SOCIETY.

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THE Ordinary Monthly Meeting of the Geographical Society took place in their Rooms, on Thursday, the 17th August, Rear Admiral Sir Henry Leeke, President, in the Chair. *Present.*—Professor Sinclair, Mirza Ali Mahomed Khan, Dhunjeebhoy Framjee, Manockjee Cursetjee, Venaikrow Juggonathjee, and Dr. Buist, *Secretary.* A note was read from Mr. Frere, of the Sudder Adawlut, expressing his regret at his inability to attend, and his great anxiety to see the Society restored to its former state of usefulness. The Minutes of last Meeting having been read and approved of, Dr. Buist stated that he begged to report his return to the Presidency, and his readiness to resume his office of Secretary. The offer having been accepted, and the Secretary congratulated on his reappearance amongst them, a vote of thanks was recorded to Dr. Bhawoo Dajee, the Acting Secretary for the past fourteen months.

The following papers were then laid before the meeting:—

LETTERS.—No. 2,506 of 1854, from C. E. Fraser Tytler, Esquire, Secretary to Government, General Department, and letters from Admiral Sir Francis Beaufort, Hydrographer to H. M.'s Lords of the Admiralty, and Lieutenant H. G. Raverty, Assistant Commissioner in the Punjab.

Two Specimens of Bottle Logs thrown over board from the P. and O. Steamers, and picked up in the Straits of Malacca, were exhibited.

BOOKS.—Madras Meteorological Observations from 1846-50. Presented by Government.

The World encompassed by Sir Francis Drake, by W. S. W. Vaux, Esquire. Presented by the Hakluyt Society.

Dr. Buist then rose and said that it was vain any longer to keep out of view the unhappy state of decadence into which the Society had fallen, and the object now was boldly to fix their eyes on the position in which they stood with a view to endeavour to restore matters at least to their former condition of prosperity. He continued,—

We began the year with betwixt 80 and 90 members, we closed it with little more than 70, our list being reduced by 17, or nearly one-fourth in the course of the

twelvemonth. Out of twenty-four meeting days, betwixt July 1852 and July 1854, there appear to have been ten when there were no meetings at all; one at which the Society seemed to have proceeded with business when the chairman and secretary were the only parties present, an irregularity that appears to have been passed over. On six occasions there were no more than three members present, on six others there were five, once there were six, and on the occasion of the greatest multitude, the chairman might have exclaimed with Wordsworth's little child, 'We are seven.' Our native members, to their credit be it spoken, though forming a very small proportion of those on the list, seem always to have formed the majority at the Meetings. I have not included the Secretary in my enumeration, he being merely the servant of the Society, present only on compulsion. During these two years there seemed to have been no more than five papers laid on the Table—there is nothing to show that any of them were ever read. And the circumstance is fresh in my recollection of paper after paper, such as those which meet with the utmost acceptation at home, being attempted to be read, when the reader was either interrupted by some one remarking that his observations would be studied time enough in the Transactions, or being left, like the Dean of Saint Patrick's addressing his dearly beloved Roger, speaking to the President nearly the only auditor left, he most likely remaining like Sterne's startling, because he could not get out.

It was not difficult to trace the cause of this unhappy state of things, the abandonment or the completion of Surveys, and the unhappy state of war which betwixt 1836 and 1842 raged along our North-West Frontier had hermetically sealed against us regions little known, of unbounded interest, and which just before had been the favorite resort of travellers, so that, the supplies of papers purely Geographical naturally dried up. On this, the Society resolved to fall back upon investigations in the wider field of Physical Geography, such as their founders had originally prescribed for themselves. In 1845, these became fully developed, and met the cordial approval of all parties, and received a promise from Government of all the assistance that could be given. But out of this almost immediately followed the most unlooked for dissensions amongst the members, resulting in a long train of wranglings and misunderstandings, painfully recorded in the Reports, fresh in the recollection of most of the members, and which eventuated, as it was clearly seen, they must necessarily eventuate, in the unhappy state of matters which now obtains. To recall these more minutely than I have done, is to some extent superfluous, and might re-awaken animosities or re-open questions, we are all disposed to suffer to sleep. From the obstructions so unaccountably thrown by members of the Society themselves in the noble path of enquiry on which we had commenced, we have been compelled to abandon that path altogether, while those who most actively shared in these inauspicious proceedings are no longer amongst us. We have now therefore before us a fair field with everything that is favorable for its cultivation, and without dwelling too minutely on the past, our object ought to be to see how lost time can be redeemed for the future. Geography in its widest sense includes so large a sweep of things that are popular and involves so little that is necessarily dry, that it would seem most singular, if

Franklin or his companions. They had themselves added very largely to our knowledge of Arctic geography.

In reference to the proceedings of the Society, and the notice in the Appendix of our bottle log experiments, it may be mentioned that the title of the map, "Survey of the Arabian Sea, by Mr. Taylor," (p. lxix,) from being abridged may be misunderstood: the full title being "Chart of the Arabian Sea—shewing the winds and currents during the S. W. Monsoon, with probably the best track for steamers from Bombay to Aden in that season, compiled from upwards of a hundred logs of vessels of the Indian Navy, by Lieut. A. D. Taylor."

The following Notification has since May been published by the Commander-in-Chief of the Indian Navy, in reference to the Skeleton Charts published by Mr. Johnston, of Edinburgh, in June 1854, and the bottle log observations in which the Society has taken so large and so deep an interest since 1852 :—

"The Commander of each vessel that may leave for a distant station during the next six months will indent on the Indian Naval Draftsman for an Atlas containing blank maps of the Indian Seas for the purpose of noting the Winds and Currents.

"These Atlases are to be sent to the Commander in Chief on the return of each vessel to the Presidency, and are to be again obtained from the Commander in Chief's office on the vessel being about to leave the Port on another cruize.

"The Commander in Chief relies upon the several officers, commanding vessels, for inserting in the blank maps all information in their power likely to prove either of general utility to Navigation or of interest to the Scientific World.

"The Commander in Chief begs also to remind the Commanding Officer of each vessel of the Hon'ble Company's Ships how very desirable it is that attention should be given to throwing overboard the bottle logs when at sea as often as they can, at noon, and to be particular that they are properly filled up, a note being made at the time in the Log Book."

As the party to whom the publication of the Skeleton Atlas is due, is the same who brought the bottle log system of observation into existence, it is but fair to mention that neither the one project, nor the other, took its rise from the Society as a body. When the system of obstructing the independent exertions of the Society, referred to at p. ii. in the report of August 1854, was in most active operation, the Secretary took these matters into his own hands as an individual, as the only way of getting on, becoming personally responsible for the charges.

The Atlases, the omission of which in the official list is noticed at page lxxiii, were despatched from the India House in June 1854. They were first adverted to as having reached Bombay in August 1855—while Government was supplied with bottle logs, noticed at the same date in September 1852.

that which every where throughout the world is found so attractive, should here be neglected. The Presidency forms the seat of Government, the Head Quarters of an Army of above 70,000 men, of a Navy of above thirty ships of War containing close on 200 Commissioned Officers. Betwixt four and five hundred square rigged vessels with from a 1,000 to 1,500 officers of intelligence on board, and bearing amongst them a freight of 200,000 Tons, worth six millions sterling, annually resort to our port. From 70 to 100 of these with from 2 to 300 officers are generally at one time in the harbour. With two Supreme Courts and their office bearers, and a numerously appointed bar, we have a large Mercantile community, Native and European, deeply interested in the science of Geography, and who in the early part of our career took a large share in the proceedings. The charges of our Society—15 Rs. annually, with no fee of admission—are so insignificant, that they ought to be no obstruction whatever; and the facilities of admission have always appeared to me to be almost too great. But this is not all; with a liberality which if equalled any where can no where be surpassed, we have thrown our meetings open to the public, merely retaining the nominal power of closing them when we desire to be alone. Every member has a right to give admission to two friends, and to avoid all formality or trouble, any person presenting himself in the lobby will at any time be welcomed by the members present. There are times, but they are of a rare occurrence, when we wish to be alone, and then we refuse admission to strangers, or desire them to withdraw, and there may be obnoxious individuals against whom the power of exclusion would be exercised in the absence of a member's order. If our library is not very large, it contains a varied collection of books of general interest, and much more than sufficient for our wants. We have generally in our Rooms a supply of instruments, new and beautiful in form, and which cannot be surpassed in excellence, and we have a collection—thanks to the liberality of the Lords of the Admiralty, the Bombay Government, and the Subscribers to the Ross Testimonial—of Atlasses, Charts, and Maps, such as is not to be met with, save in the United States, any where out of Europe. To all these the Public at large have as free access, within the rooms of the Society, as if they were their own. Any man, by permission of the secretary, and if connected with Navigation, even this small formality is dispensed with, may from 10 to 5 any day or every day in the week use our Rooms as his study. He may examine our atlasses, copy our charts, or read our books—he will find comfortable accommodation, pencils, pens, ink and paper, tracing glasses and tracing paper with everything else he can desire, free of all charge and without so much as an honorarium to the door-keeper. Surely it might be supposed that things to be met with no where else without great expence and trouble, which are not attainable elsewhere in the East, on any terms whatever would present to the intelligent Navigator attractions as great as the Smoking Room or Billiard Room of an Hotel, of the Dubashes' Office, or Parsee Gup Shop. I have stated these things not that they are unknown to any one present, but with the object of their finding their way out of doors, feeling confident that it is the ignorance prevailing in regard to us that has caused us to be neglected, and that were our economy and proceedings more ge-

nerally known, our Rooms would be more frequently resorted to, and Geography would be greatly benefitted thereby. In the Societies at home, ladies as well as gentlemen are to be found in numbers amongst the visitors, and I see no reason why the same should not be the case amongst ourselves. It would be a poor compliment certainly to Englishwomen in India to suppose them unlikely to take an interest in those matters in which ladies of their own rank everywhere else appear interested, and it surely should do something to improve the tone of conversation, the vapidity of which, amongst us, is such frequent subject of complaint were our wives, sisters or daughters, sharing in the more elegant or intellectual of our pursuits, to have ideas suggested to them, or topics supplied in the discussion of which all would share. There is no science more eminently popular, than Geography, or less necessarily dry, and Lectures such as those given at home in absence of, or in addition to, original papers, intended for our transactions, might be made eminently interesting and instructive, and if to the more accomplished of our Members, not altogether new, might to a certain extent be so to all, in a great measure to many, and wholly so to not a few. To enhance the attractions of societies at home, specimens of everything that is new, curious, or rare, bearing on the topics discussed, are scattered about through the rooms or exhibited on the table, and the same thing might be done here with equal advantage as at home. There are probably very few of us who have not every month of the year things passing through our hands an intelligent audience would desire to examine. At home so soon as a paper or lecture is read, a discussion ensues, which often occupies longer time and is of greater interest than the formal prelections that preceded it. In this every one can take a share, and those who may not have time or inclination for the preparation of an Essay can bring out the knowledge they possess, or information and explanations they may desire to obtain, in the discussion. It is melancholy to think of the contrast our societies in their best estate present to societies organized at home for the promotion of the objects we have in view, still more so to review the proceedings, or rather the no proceedings, of the past two years, and to reflect that it was only in 1848 that we commuted our Quarterly into Monthly Meetings, to be enabled to overtake the business with which our Tables were then becoming loaded. The Anniversary address laid before you in 1850, is now nearly in whole or in fragments to be found in the Washington Observatory Reports, in the Reports of the British Association, in the Edinburgh Philosophical Journal, in Johnson's Physical Geography, in Lyell's Geology and others of the most Standard Works of our time. In former days no survey or journey used to be undertaken without the matter coming in some shape or other before us. Our minutes and our transactious bear intimations of this character from Layard, Burnes, Masson, Wood, Harris, Kraapff, and Isenberg, and I know not how many more besides. From the public prints we observe that surveys have been lately finished of Bombay harbour and the Malabar Coast, in the Gulf of Cambay and Cutch, off the shores of Scinde, and along those of Mekran —but not a single line on these subjects is to be found in our records, or has ever been before us—nay while supplied by H. M.'s Lords of the Admiralty and by the Governments of India with every thing pertaining to the Eastern Seas, engraved

at home, we fall in from time to time out of doors with charts compiled by the Hydrographer of the Indian Navy and lithographed at Bombay, which have never found their way into our archives, a matter which I trust our President will duly bring under the notice of the Commander in Chief and Commodore. [*A laugh.*] We see by the newspapers that an expedition has lately been organized to proceed into the Sumali country, and we have repeatedly published papers in our Transactions on this very subject—yet unless through the newspapers we know nothing whatever of the matter, though the alleged principal of the mission has just completed a journey through Arabia at the instance and expense of our London parent. The parties and the means by which this deplorable state of matters has been brought to pass, might readily be pointed out, and will probably occur to most of us, but the thing now is to see how we might best improve our position, and I believe if the members set heartily abut it, the task need not be a difficult one. As for twelve years Secretary of the Society, I consider myself bound to exonerate our President from all blame in the matter. When he accepted office he promised to be regular in his attendance at the meetings, and to do every thing in his power to promote our views,—but then nothing can be done for men who will do nothing for themselves, and as to attendance, I told him that I should keep him informed when a quorum was likely to convene or there was otherwise any probability of any business being transacted, and on the few and rare occasions when such things occured, he was always to be found at his post. I confess, I think it would have been a grievous waste of time for a gentleman at the head of an important public department to have thought of coming up once a month from the Marine Office to the Town Hall, when all that he could have done would have been like a Scotch house-breaker to " gang back again." I have not put in the form of a motion or of resolutions, the suggestions with which I mean to conclude, because they can be carried out without such a formality as well as with it, and no formality whatever will in aught avail us unless we individually resolve to exert ourselves.—They are these :—*First*, That members do hereafter be more regular in their attendance, and that they endeavor to bring with them as many of their friends, whether male or female, as seem disposed to attend. *Second*, That the Secretary be instructed to see that papers or lectures of interest be provided for each meeting, such as may occupy from half an hour to an hour—that these be illustrated by drawings or specimens ; that collections of whatever may interest or attract hearing in any way on the objects of the Society may be exhibited at the meetings, and that suitable accommodation may be provided for the audience. *Third*, That all matters of routine, generally brought before the meetings be, in as far as the regulations allow, disposed of by the Committee, and that these last be at all times rigidly enforced. *Fourth*, That a sufficient number of copies of the reports of the proceedings, such as are afterwards published as a preface to the Transactions, be struck off in pamphlet form for the use of members as speedily after the meeting as possible, and that these suggestions be endeavoured to be carried into effect from the present time.

The *Chairman*, after some explanations as to the Charts not received by the

Society, said that he most cordially concurred in everything that had fallen from the Secretary, and should for his own part do his uttermost, as he hoped the other members would do, to give effect to suggestions so excellent. He entertained no doubt whatever that were a vigorous effort made, the Society might speedily be enabled to resume the position it had lost, or to take up one still more distinguished.

The members present expressed their cordial concurrence.

The Secretary then stated, that to avoid the error which he complained of in others, he might mention an expedition he himself had in contemplation when he next proceeded to England, which might very probably be next spring. He had the fortune to read, in April last, a paper before the Royal Geographical Society of London, upon the Hydrography and Geology of the Red Sea, when Sir Roderick Murchison expressed his "great satisfaction in having occuped the chair when a memoir containing so many geographical data bearing on geology had been communicated in so clear and intelligent a manner, and hoped that the public autthorities would employ so able a man as Dr. Buist in a special natural historical survey of the Red Sea, by which we might obtain as accurate an acquaintance with it as we have obtained of the Mediterranean through the researches of Admiral Smyth. With regard to the survey of the Wadi Araba, he (Sir Roderick) had upon several occasions brought its desirability before the proper authorities." Resolving to act upon this hint, he intended to proceed from Suez to Akabah, and thence carefully to take the levels of the Wadi Araba—thence descending to the shores of the Dead Sea, he proposed reascending by the longest section of the hollow along the valley of the Jordan and so up to the old sea margin until reaching the level of the Mediterranean,—thence proceeding Eastward and Nothward as far as was found expedient, and so round again by the upper old sea margin till opposite the old port of Tyre. By this means the area, the new Sea would occupy, were the Canal suggested by Captain Allan opened, would be ascertained, together with the numberless singular phenomena presenting themselves in the great hollow, and which had hitherto been so imperfectly described, vast as was their importance in Physical Geography. A series of levels would then be run across to the Mediterranean, a distance of less than thirty miles, and the feasibility of the Canal project thus tested. Should a greater amount of leisure present itself, should the services of a Government vessel be obtainable, and other circumstances permit, he hoped to commence his survey at Aden.—To take deep sea sounding and observations on the submarine currents, and of the saltness, and temperature of the water from the Straits up. To make Geological Survey with drawings of Photographs of all the volcanoes and volcanic islands as he proceeded. The Northernmost of these, purely volcanic, appeared to be Gibbal Tear, in latitude 15°30′, and which had been in a state of constant, though moderate, activity for the past eighty years. From the descriptions of Moresby and other Surveyors, and from the observations he had made in his late voyages up and down, it was quite obvious that both the nummulite and coral islands as high up as Ras Mahomed were split and rent through by veins and jets of lava, which appear like the traces of huge black racks in all directions.

The great volcanic field betwixt the 11 and 16 parallels from the 38th to the 45th meridian occupies an area of from 10 to 15,000 square miles, and is probably the third largest in the world, but there is reason to suppose that at least 600 miles to the northward of this, the earth was rent in all directions by subterranean heat, and that veins of lava may now be traced in all directions penetrating many of the most recent of our tertiary rocks.

After some business of routine the meeting broke up.

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THE Ordinary Monthly Meeting of the Society was held in the Town Hall, on Thursday afternoon, 14th Sept., when a large number of visitors were present Amongst others we observed The Right Hon'ble the Governor, Mrs. Jenkins, Mrs. Pope, Mrs. Haines, Miss Pope, Miss Duncan, The Hon'ble Mr. Lumsden, Colonels Lyons, Pope and Willoughby, the Revd. Messrs. Robertson and Peniston. Commander Hewett, Lieut. Fergusson and Lieutanan Annesley, Messrs. Frere, Young, Tytler, Bhawoo Dajee, Manockjee Cursetjee, Narrayen Dajee, Sinclair, Venayek Juggonathjee, Dhunjeebhoy Framjee. Manackjee Nusserwanjee, McKenzie. Dunn, Buchan, Johnstone, T. L. Jenkins, E. Elsam, Bentley, F. A. Spencer, Heycock, Cuvilier, Narrayen Dinnanathjee. Blacknight, Dadabhoy Nowrojee, Jehangeer Burjorjee, Drs. Stovell, Carter, Haines, Peele, Mackenzie, and Lord Emmanuel Gordon, &c. &c. &c.

It was agreed that the various specimens of Rock Salt now in the Society's possession, should be presented to the Museum of Economic Geology, Jermyn Street, London. Mr. Frere gave notice of a motion that from henceforth the Society should meet on the third in place of the second Thursday of the month —the meeting now to stand adjourned to the 19th of October.

The ordinary business of the Meeting having terminated, Sir Henry Leeke, the President of the Society, made a few observations in reference to the establishment, past proceedings and the prospects of the Society.

The following lecture was then delivered on the principal depressions on the surface of the Globe :—

DR. BUIST said, "When the crust of the whole earth, or any portion thereof, first assumed its present character and conformation, it must necessarily have been devoid of rivers until a sufficiency of rain fell to moisten its surface, fill up its hollows, and occasion an overflow ; the surplus water passing off in the form of rivulets, brooks, streams, or rivers, to the nearest lower level, and so downward till they found their way to the sea. If we assume the dry land all at one time to have been submerged, and all to have risen directly, either at once or through a long succession of elevations, to its present level, such of the spaces as were depressed below the surrounding country at the time of their emergence, and that so continued, would of course be filled with salt water, and would probably thus remain, either until evaporation converted it into a mass of solid salt, or until, washed down to the sea by the rains, its place came to be occupied by

pure water. In many places, as will presently be seen, fragments of the primeval ocean remain in the bosoms of our continents in nearly the condition in which they originally appeared. Though the most stupendous disturbances and frightful distortions amongst the rocky beds must have occurred at the time of their elevation, there can be no doubt that change and commotion continued long after this, and that ridges, hills, and mountains rose, chasms were split open, and valleys sunk every where in multitudes throughout the whole lapse of intervening time; examples of such things occasionally occurring in volcanic countries down to our own day.

Just 280 years before Christ the great fresh-water lake of Oitr in Japan was formed in one night by a prodigious sinking of the ground, at the same time that one of the highest and most active volcanoes in the island rose into existence. The volcanic peak of Jurullo, on the table-land of Mexico, 70 miles from the Pacific, rose on the night of the 29th September 1759, 1,683 feet above the plain, and is the highest of six mountains that have been thrown up on the table-land since the middle of last century. In July 1757 a volcanic island arose off Pondicherry, near Madras, and after remaining for several days above the water, throwing out smoke and flame, disappeared. About the same time Chedooba, and the islands along the shores of Arracan, were suddenly raised about ten feet, having twice before, at intervals, as is supposed, of half a century, sustained simliar up-heavals. In 1762, during a violent earthquake, a mountain sank and disappeared near Chittagong, in the upper part of the Bay of Bengal; another descended till the summit alone remained visible, while 60 square miles of sea shore were permanently submerged. In 1831 a volcano called Graham's Island rose on the coast of Sicily to the height of 800 feet, and, after continuing in active conflagration for three months, sank down and vanished beneath the waters; and in June 1819, the Runn of Cutch, in our own neighbourhood, sank down, and became a salt water marsh—a vast mound, called the Ulla Bund, rising in its neighbourhood, and cutting off from the sea one of the mouths of the Indus. The island of Bombay and plains of the Deccan must at one time have been on the same level with each other.

So soon as rain began to fall, all the hollows would be filled up, and transformed into lakes, either with rivers running into them, or out of them, or both. Our great river systems now first make their appearance, and connect in long reaches of nearly stagnant water the original hollows, now transformed into lakes united together by rapids and cataracts. In process of time the more shallow and inconsiderable of these pools would become filled up with mud or gravel, assisted by the hitches and upheavals to which the crust of the earth from the first seems to have been periodically subjected, forming our haughs, carses, and holmes, the only depressions remaining permanently as lakes being those near the sources of rivers, where the feeders that supplied them, being inconsiderable in size, brought comparatively little solid matter along with them, rendering the process of filling up infinitely slow. All our lakes, however, are in process of gradual obliteration, more solid matter being carried into them than finds its way out, and all that is required is a sufficient lapse of time to accomplish their extinction, when

those at the sources of our streams will undergo the transformation into plains and levels their predecessors along their tracks have already undergone. The depth of many of our lakes is very great indeed, the bottom of their basins being often far below the level of the sea ; so that were their supplies of water diminished or the evaporation from their surfaces increased, we should have examples presented us wherever this prevailed parallel to that with the lakes of Asphaltites, Assal, Tiberias, the Caspian Sea, and many others, of a pool of entirely salt water at the bottom of a hollow lower than the level of the sea ; and to this class of hollows only do we give the name of depressions.

The bottoms of Lochness and some of the other lakes along the line of the Caledonian canal, are not only below the level of the surface of the German Ocean, but beneath that of its bed anywhere in the line of their axis across to the shores of Norway.

Were the Straits of Babelmandeb closed, the Red Sea would be all but dried up in a moderate lapse of years, presenting us with a huge chasm, in some places half a mile in depth, with a long narrow bitter lake, margined with rock-salt at the bottom.

The following are some of the dimensions of the most notable of our lakes :—

| Names. | Area. | Elevation of surface. | Depth. | Bottom below Sea. |
|---|---|---|---|---|
| | Sq. miles. | Feet. | Feet. | Feet. |
| Geneva........... | 240 | 1,230 | 1,012 | .............. |
| Superior... ...... | 32,000 | 672 | 932 | 300 |
| Ontario... ....... | ............... | 279 | 547 | 268 |
| Titicaca.......... | 2,225 | 12,846 | 720 | .............. |
| Tiberias... ...... | 50 | —329* | 165 | 494 |
| Dead Sea......... | 185 | —1,312 | 1,300 | 2,612 |
| Caspian Sea..... | 140,000 | —82 | .............. | 82 |

I shall turn next to the great continental river basins, or valleys of no outlet, where the rivers on all sides flow towards some central lake or lakes, and the whole of their waters are carried off by evaporation. These may be

* Mrs. Somerville says in a note on these depressions that the level of Tiberias as given by actual measurement of Symonds is not to be relied upon, as it falls short by above 100 feet of that determined barometrically by three different observers—Berton, Russerger, and Von Wildenbruch, who give the mean at 755—the mean assigned to the Dead Sea by the travellers is 1423.5. With great deference to so distinguished an authority as Mrs Somerville, I should certainly prefer the most ordinary levelling over so moderate a distance to the best barometric measurements where there could be no good barometer of reference to fall back upon. The hour of the day might make all this difference—the barometer read at 10 or 4 without a corresponding reading at the same level at exactly the same hour would give an error of 100 feet.

classed under two divisions—those above, and those beneath the level of the ocean, and the first we must note of the first class are those of America, the most notable being that of the Great Salt Lake of the Rocky Mountains, which, as will by and bye be seen, in many points closely resembles the Dead Sea. The Great Salt Lake, until then chiefly familiar to us by name from the Mormon settlement on its borders, was first explored by the American Government in 1847, by an expedition under Fremont, which seems to have been mainly one of general inspection : a second expedition under Captain Stansbury, U. S. Engineers,* laid down a base of six miles near the lake, and made an elaborate and careful trigonometrical survey of the whole district. It is situated betwixt the 42nd and 43rd parallels,—about the 115th western meridian,—in the bosom of the Rocky Mountains, betwixt the Missouri and the Pacific. Vast inhospitable tracks of country prevail to the North and South of it : on the east, for the space of nearly 1,000 miles, are the trackless and barren steppes of the Rocky Mountains—a similar extent of salt desert bordering it to the west. The place where the Mormons have taken up their abode is one of the most isolated and extraordinary the world contains—remarkable for its beauty and fertility on the very borders of the most unspeakable desolation. The Valley of the Salt Lake is about 4,000 feet above the level of the sea, and is about 500 miles either way in extent. This space, which is enclosed by a circle of rugged precipices and majestic mountains, consists of great stretches of salt desert, perfectly smooth and level, bearing all the marks of marine origin. Some of these are from 60 to 70 miles across ; and they are separated from each other by precipitous rocky eminences of great elevation. On the slopes which bound the plain are a series of thirteen distinct terraces or beaches, the highest of them being about 200 feet above the valley, and to all appearance the margins of a former sea, which had subsided by intervals, and left behind it the marks where it had for a time remained at rest. There are many valleys and recesses amongst the Rocky Mountains with terraced slopes similar to those just described, having all the appearance of the basin, of former seas. Within the basin, but at a much higher level, besides the Great Salt Lake itself, is the fresh-water lake Utah, from which flows a stream of considerable magnitude, on which the name of the Jordan has been bestowed, and which, after passing the Mormon settlement, discharges itself into the Salt Lake. The Salt Lake itself is nearly 300 miles in circuit, including all its indentations, and is about 70 miles in length and 20 in breadth. It is studded with mountain islands, springing up abruptly from the surface of the water to altitudes of from 500 to 1,000 feet, Antelope Island rising to the height of 3,000 feet ; eminences of similar form and size, which had been islands before the waters shrunk within their present dimensions, being scattered about over the adjoining plains. The waters of the lake contain 22 per cent. of saline matter, or about the same quantity as the

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* I have not been able to refer to the American works themselves (they are in none of our libraries); but take my information at second hand from the *Athenæum*, Oct. 1852 ; *Jameson's Journal*, 1852 ; and *Chambers' Journal*, 1853. A good outline of the Salt Lake is reserved for future works on physical geography.

Dead Sea. Of this 20 per cent is pure chloride of sodium or sea salt : it is said to throw down in summer muriate of soda, and in winter sulphate of soda or glauber salts—a circumstance that seems so strange that better evidence than we possess is requisite before the fact can be accepted as established. They are so acrid as to be dangerous to animal life, and even so affect and corrugate the throat when swallowed that a mouthful would be fatal. They are so heavy that the body floats on them without effort, about a sixth of its mass remaining above the surface. The lake itself is singularly shallow . its greatest depth is 33 feet, and in some places a stiff breeze blows the water altogether to one side, and leaves large expanses of the bottom bare. At no distant period the lake seems to have been many times its present size, and to have covered the low-lands around with its waters. It seems still diminishing in size, the balance betwixt fall and evaporation not having as yet been attained in a climate where little rain falls, and the atmosphere is intensely dry. Amidst all its stern grandeur the scene around is one of dreary and oppressive desolation : there is no tree or plant to relieve the eye, the atmosphere feels hot and suffocating, and the sluggish waves scarcely ripple before the breeze. Along one side of the lake the surface of the earth is covered with a sheet of solid salt of the most dazzling whiteness this is converted into a muddy marsh by every shower of rain. Various streams of fresh water flow into the lake from the neighbouring mountains,—the Jordon, Bear River and Weber being all of considerable size,—and the banks of these before they enter the salt region are covered with the richest vegetation. Hot springs and salt in masses abound in the neighbourhood of the lake. Around its margin is a band of soft, fœtid, slimy mud, consisting entirely of the larvæ of insects, or other animal matter, emitting smells the most offensive that can be imagined. All around are evidences of volcanic action, and thick cakes of mud, six or eight inches in diameter, charged with sulphur, and erupted in a semi-liquid form from small spiracles beneath are found scattered about. In the plain, at no great distance from the lake,* is a group of volcanic cones and apertures covering several acres of ground, with steam and mud issuing from at least half a dozen of chimneys. The cones are from four to six feet in elevation, terminating in a spiracle or vent, some of which are hardened, and lined with crystals of sulphur, and other substances. From one of these steam and water are thrown from ten to fifteen feet into the air—they rush out with a noise resembling the escape of a steam engine ; the water is hot and cold by turns, and is strongly impregnated with sal-ammoniac. Some of the cauldrons are from ten to twenty feet in diameter, filled to within three or four feet of the top with boiling mud, which occasionally runs over. Besides the numerous mud cones, there is one of lava, in the midst of a mass of volcanic rocks within the valley : it is about 50 feet in height, sheets of salt, strongly impregnated with sal-ammoniac surrounding its base. In the mountains, not far off, are wells of petroleum and naphtha.

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* American Annual of Scientific Discovery for 1852, *Jameson's Journal*, No. 105, P. 180

If I have bestowed more space on the Great Salt Lake than I ought to have done, or than time will allow to devote to other depressions of equal interest, it is because it has but lately become known to us, and I am aware of no single paper or work in which all the information that has been collected regarding it is to be found in moderate compass,—as already mentioned, the latest of our physical atlasses and physical geographies fail to bring our information down to this point. I have no doubt it will be treated with his usual care and ability by my friend Mr. Keith Johnstone in the new edition of his great work now preparing for the press.

There are besides the Valley of the Great Salt Lake, whose mere magnitude is the point of least interest about it, two depressions, or continental river basin of no discharge north of Mexico, on the highlands betwixt the Gulf of California and Rio del Norte, one of about 200 by 50 miles, betwixt the 29th and 33rd parallels; another about four times this size, nearly under the tropics. Both contain salt lakes of some magnitude, with fresh-water streams flowing into them. Beyond this little is known regarding them. The Rio Grande, about 300 miles in length, is the largest river in this quarter swallowed up by evaporation ; and but for these continental streams the country would be doomed to a state of perpetual sterility—a few showers occurring in September being all the rain that ever falls in the neighbourhood.

In the great Andes plateau in South America stretching from the Tropic of Cancer northwards for the space of 1,200 miles, with a mean breadth of 200, is a depression with a surface area equal about that of the Red Sea. This basin is about 12,000 feet above the level of the ocean, the principal lake being that of Titicaca, occurring at an altitude equal to that of Teneriffe. It is about 26,000 square miles in area, and 700 feet in depth. The scenery and verdure around seem in the last degree rich and beautiful, and the climate delightful.

There are no continental river basins or valleys of any extent in any part of Europe, the rains being sufficiently abundant, and evaporation moderate enough, to enable the moisture which falls to accumulate in the valleys till it forms lakes which discharge their waters into rivers, all finding their way to the sea ; and the only depressions at all resembling those under consideration, and of the same character, though of inconsiderable depth, and due, doubtless, to the same causes, are those in Holland—the Lake Harlaem and the Zuyder Zee.

We know so little of Central Africa that we are unable to speak of its characteristic features with anything like certainty. From the magnitude of some of the lakes known to exist, and the streams made mention of, compared to the scantiness of the discharge of fresh water into the sea, there is reason to believe in continental river basins great in number and vast in size. The only depressions well known to us are those of the lake Mareotis, on the Mediterranean shore, close by Alexandria, of the Bitter Lakes in the Isthmus of Suez, like Mareotis, and the Natron Lakes, all in Lower Egypt, and Lake Assal, off the shores of the Gulf of Aden, a short way into Abyssinia. The first of these depressions has probably

been seen by most of you who have made the journey overland. It seems to have been formed by a sinking of the Delta up to close upon the shore, where a barrier was left; it is at its lowest some six or eight feet below the Mediterranean, and occupies an area of about 5,000 square miles, being about 30 across and 150 in length. It seems to have been a fresh water marsh in Pliny's time, when the Nile was admitted to it by Canal, and it was transformed into a lake. By the end of last century it had become nearly dried up, and its ancient bed, remarkable for its fertility, was irrigated by canals from the Nile. In 1788, during the siege of Alexandria, then held by the French against the English, a letter was found on the body of General Roitz, expressing alarm lest the sea should be admitted to the lake Mareotis, and the town deprived of fresh water. The hint was taken by the British General, and the barrier cut across. The vast plain was immediately submerged, the sites of 300 villages were flooded, and one of the most fertile and profitable portions of Egypt—the very garden of the Nile—reduced to sterility. For ten or fifteen miles the railway skirts or traverses the margin of the lake, so as to bring it within the view of overland passengers betwixt Europe and the East. Near the period of low Nile the waters of the lake are concentrated by evaporation up close to the point of saturation, and vast sheets of salt of dazzling whiteness, the reflection of which is seen in the sky far out at sea, spread over the shallows round its borders, to be redissolved when the waters of the Nile are admitted during the inundation. A benevolent Government or enterprising people would speedily pump out the brine by steam, and restore the soil to its wonted fertility by repeated washings from the Nile. As matters at present stand it is likely to remain for ages, until the Nile silts it up to the level of the sea, a monument of the cruelties wars of aggression inflict or compel, and of the apathy and indifference of an administration which makes no attempt to heal the wounds after they have been inflicted.

The Bitter Lakes occupy a series of hollows about 30 miles in length, 10 in breadth, and 50 feet in depth, under high water mark in the narrow neck of land intervening betwixt the Red and Mediterranean Seas. They seem at one time to have formed the upper portion of the Gulf of Suez, which was cut off from them by the rising of the desert barrier of about 13 miles, which now divides them. The water now found in them is extremely salt and bitter—the result of concentration. The Isthmus, which is only 70 miles from sea to sea, seems within the last 4,000 years to have been subjected to frequent elevations and depressions, the latest of which in all likelihood occured a considerable time after the Exodus.

The Natron Lakes, in the upper part of the Delta, are also completely isolated, and occupy a depression of considerable but uncertain depth. In summer they are nearly saturated with salt, the muriate and subcarbonate of soda, or the sea-salt and soda of commerce. In winter they rise, and become freshed, from the percolation of the waters of the Nile, which appear to take about three months to force a passage through the porous soil beneath.

Before noticing Palestine, close by the locality just being described, we shall close the account of the known depressions in Africa with a notice of the

lake of Assal, on the Somali shore opposite Aden. The lake was, I believe first surveyed by the party of Sir W. Harris, in 1841: it is described by him, as well as by Dr. Kirk and Captain Barker, who took its level and dimensions. It is in lat. 11° 33′ 12″ N., long 42° 30′ 6″ E. It is about 7 miles in length, 16 in circumference; and its surface is 570 feet beneath the level of the sea. No stream or rivulet enters it, or flows from it; scarcely any rain ever falls in its neighbourhood; its waters dried up and concentrated by evaporation, have nearly reached the point of saturation, and about one-third the lake is at certain seasons covered with a sheet of solid salt. It is separated from the outer sea, of which it at one time formed a part by a barrier of lava, cracked and rent in all directions, the whole being obviously the result of recent volcanic agency, accomplished, probably, when the vast group of cones extending from Aden 500 miles into Abyssinia, and at least 300 up the Red Sea, were in a state of conflagration. Under operations so violent and extensive as may then be supposed to have been in progress, the upheaval of a barrier a few dozens of miles across, and severation from the sea of a lake, about the size of the island of Bombay, would appear a very trifling affair.

Turning from Assal I shall take up the depressions in India, few and inconsiderable as they are, before dealing with those of Western and Central Asia. The most noticeable are the Runn of Cutch, the Boke, the Null, and Lake Loonar. The remarkable thing about the first of these is that it has obviously been subjected to a variety of descents and upheavals within the human or probably historic period. Any one who reads the Periplus with care, will, I think, come to the conclusion that a vast space from the Indus Eastward which is now dry land was in the time of Alexander covered by the waves. There is a Hindoo tradition that the sea in days of yore swept over the present Runn and extended for many miles beyond it, and a line of positions along the old sea margin indicate by their names the ports, custom houses, and other chief points along the shore. A saint offended with the wickedness of the people cursed the land, and ordered the sea to retire, an event believed by Colonel Grant to have occurred in the eleventh century. The ruins of the city of Bhalibapoora near Bhownuggur are now found from ten to fifteen feet below the surface of the soil; but the houses it is clear must have been constructed on dry land, and sunk beneath the waves for at least the distance just named, when a fresh upheaval brought the whole up to its present position. The Runn of Cutch now vastly circumscribed in its area from the time of the holy man's malediction, was to a considerable extent submerged by the Earthquake of the 16th of June 1819, of which sufficient mention has already been made, and now forms in part a lake, in part a salt water marsh. Considerably to the north of this in the Collectorate of Ahmedabad are two remarkable hollows some way from each other, called the Null and the Boke. They both appear the results of volcanic agency, the water they contain is salt, they receive supplies from rivulets but give off none. The only other hollow in India of any note is the basin of Lake Loonar, a depression situated among the Shiel Hills in the centre of the Deccan. It is about 500 feet below

the level of the surrounding country, and seems to be the crater of an extinct volcano, lava being in abundance at no great distance. The water it contains is nearly saturated with subcarbonate of soda, the Natron of the lakes of Egypt.

We now come to the consideration of the largest and most wonderful depression in the world,—that of the north-east of Asia,—not including that of the Dead Sea, an account of which will be given last. From the borders of the Gulf of Finland and the Black Sea to those of the Yellow Sea, extending all across Central Asia, there is a space nearly 4,000 miles from east to west, and at its western extremity nearly half as much from north to south, comprising in all an area of above three millions of square miles, containing lakes and rivers numberless, but which send not one drop of water to the ocean, evaporation subliming into the air all the moisture that appears on the ground. In the western portion of this the ground sinks in some places above 80 feet beneath the level of the ocean, affording a vast space of from 760,000 to 800,000 square miles in area, or larger than the Mediterranean, to all appearance the basin of an old inland sea, at no time more than slightly connected with the Northern Ocean. This depression comprehends the whole of Trans-Oxonia, including the basins near its lowest part, of the Aral and Caspian, the surface of the latter being 83 feet beneath the Mediterranean. From his observations on these points Humboldt arrives at the following wonderful but far from improbable conclusions:—

'1. That before the times which we call historic, at epochs very near in point of time to the latest revolutions on the surface of the globe, the lake Aral may have been entirely comprehended in the basin of the Caspian Sea, and that then the great depression of Asia, (*the concavity of Tauran*,) may have formed a vast interior sea, which may have communicated on one side with the Euxine, and on the other side, by means of cracks more or less wide, with the Icy Sea, and the lakes Telegoul, Talas, and Balkhache.

'2. That even in the historic times, we must not admit too generally that the soil has followed the successive changes which seem to be indicated by the chronological series of opinions emitted by ancient historians and geographers. These authors seldom represent the geography of their epoch;—they choose between preceding opinions, and their absolute silence respecting certain facts or natural phenomena, is no argument against the existence of these phenomena.

'3. That very probably from the time of Herodotus, as at the epoch of the Macedonian expedition, the Aral formed but a lateral appendage of the Oxus, and that it communicated with the Caspian only by the arm which the Scythian Gulf of that sea extends so far to the coast, and receives the river Oxus.

'4. That either by the simple phenomenon of the increase of growth, (the preponderance of evaporation over aqueous supply,) or by plutonic crevices or elevations, the Scythian gulf (the Karabogas) has been progressively contracted in its narrowest dimensions, and that by the retreat of the gulf, the bifurcation of the Oxus has been developed, that is, has become more and more manifest. One portion of the waters of the Oxus has preserved its course towards the Caspian by a river bed which modern travellers (posterior to the middle of the

16th century) have found dried up. What was at first but an enlarged appendage of a lake which communicated laterally with the Oxus, has become the limit of the inferior course of this river. It is thus that Nature on a great scale has repeated the phenomenon, which the hydraulic systems of the Yaryakchi exhibit to the E. and N. E. of the Aral, of the Tchoui, and Talas, terminating after a course of 130 or 160 leagues in the lakes Telegoul, Kaban-koulak, and Talasgol.'

By far the most profound and striking, if not the most extensive depression on the surface of the globe is that of the Lake of Asphaltites or Dead Sea, in Palestine. The most remarkable characteristics of this lake were well known to the ancients, and it is described by Deodorus, Pliny, Strabo and Josephus, and though never surveyed with anything like tolerable care, it has for long formed a favorable resort for travellers. Lieutenant Symonds, of the Royal Engineers, in 1843, measured its depression by actual levelling, and found the surface of its waters to be 1,312 feet below those of the Mediterranean, Lieutenant Lynch, of the United States Navy, crossed and recrossed it repeatedly in 1847, taking soundings as he went. He confirms the researches of Symonds, and he speaks of having made astronomical and barometrical observations, but gives us no results; and wonderful to relate, while we organize expeditions, to examine the icy seas, at an expense of hundreds of thousands of pounds; send parties into Central Africa to search for we know not what,—mount the fearful table-lands of the Andes, and survey with philosophic care the sacred lakes of the Hindoos, hid deep in the bosom of the Himalayas,—permit officers to assume all sorts of disguises, and practise every variety of questionable deception to be enabled to violate the sanctity of the great Mahomedan shrine, and to inspect that which it is deemed sacrilege for the unbeliever to behold, and is not worth describing even if it could be legitimately seen,—we are content with merely looking at a spot of earth which has more claims on our curiosity as Christians, as well as geographers and philosophers, than any point on the surface of the globe. There is not, to our shame be it spoken, up to this moment anything like a decent or even a creditable account of the Physical Geography of Palestine in print! and the vague and general account of it now about to be given, gleaned from the best authors on the subject, meagre and unsatisfactory as it is, is half guess work. This most discreditable want it was my purpose next spring to have endeavoured to some extent to have remedied, by taking the levels from Akaba down to the Dead Sea, and so up again by the Valley of the Jordan, and to the sea level, and surveying then all round by the old sea margin by a circuit of probably some 400 or 500 miles. The fulfilment of this purpose, not unlikely to be deferred for the present by another and a very different variety of geographical operations, will, I trust, be resumed, should I ever be permitted to revisit my native country.

The Dead Sea is supposed at one time to have united with the eastern limb of the Red Sea known by the name of the Gulf of Akaba. A sloping valley of unknown elevation called the Wadi Araba, the highest part of which forming

high-water mark, and this is supposed to be within 25 or 30 miles of Akaba, the total distance betwixt the two seas being 106 miles. The fact of the Dead Sea being very much below the Mediterranean, as well as the existence of an enormous depression, enclosing and surrounding it, was known to the ancients, who conferred on it the name of Hollow Syria. One of first surmises of its enormous depth was given in 1841 by Sir David Wilkie, who made it 1,200 feet by barometrical observation—probably the extent to which his barometer was cut. Two years afterwards Lieutenant Symonds made it by levelling 1,320.2 feet, and this is now the admitted depression. Lieutenant Lynch in 1847 fathomed water to the depth of 1,300 feet, so that the hollow is in all 2,620 feet below the surface of the sea. The bottom of the sea consists of two submerged plains, one 13 feet and the other 1,300 feet, at an average, below the surface. The area and upper borders of the hollow, indicated in all likelihood by an old sea margin, and to which the waters would again rise were a canal, as has been proposed, cut into it from the Mediterranean on the one side, and Red Sea on the other, are unknown to us. Along the axis of the lake and valley of the Jordan, from the water-shed in the Wadi Araba to Cesarea and Phillipi, is probably 190 miles, with a bifurcation of about 210 miles to the eastward, terminating about Mount Hermon, where the streams run in opposite directions. Its greatest breadth appears to be about 30 to 45 miles, and the area, of the whole depression, which is very irregular in form, perhaps somewhere about 7,000 square miles. The lake itself is about 40 miles by 9, with a probable area of 185 square miles; to circuit including all its indentations seems about 420. The rocks around on the west side seem to be mainly of the chalk formation, mixed with old volcanic basalt, and occasionally to all appearance with recent lavas. Close by the lake, about one third along from the northern shore, are masses of yellowish limestone, with great beds or pillars of rock salt; and the whole soil, and bottom of the lake are covered with saline incrustations, petroleum oozing from the beach, and spreading itself in many places in films over the surface. Pieces of sulphur lie scattered around—whether the products of a volcano or the results of the decomposition of the salt does not appear. Near the mouth of the Jordan hot springs abound. Around the northern shore, and especially manifest, in the basin of the Jordan, are horizontal lines or terraces of alluvial matter on the mountains, terminating in abrupt declivities of sand, which lead again to lower terraces or beaches closely resembling those of the ocean, with here and there conical hills, with flat horizontal tops, all obviously the result of aqueous action. From these and other circumstances it is inferred that the Dead Sea was depressed to its present level, not by simple evaporation, but by the sudden sinking of its bottom sufficiently indicated by the abrupt breaks down in the bed of the Jordan. If the original theory be correct that the Dead Sea was at one time connected with the Gulf of Akaba, it is very probable that the ridge of the Wad-Araba may have risen when some of the convulsions occasioning or deepening the depression occurred, just as the Ulla Bund arose when the village of Sindree, and

the portion of the Runn of Cutch around descended in June 1819. There is not the slightest reason to associate any of these convulsions, which must have been on a scale vast enough to destroy all animal life, with the destruction of the cities of Sodom and Gomorah, and the surface of the country in the days of the Patriarchs was probably not dissimilar to what it is at the present day.

Dr. Graves enumerates a number of points in which the Great Salt Lake of America and the Dead Sea resemble each other. They are both situated in deep valleys, the mountains surrounding them being marked with terraces or old sea margins—proofs of a succession of sudden sinkings in the earth beneath. The shores of both abound with deposits of salt, with pretroleum, and with sulphur; near both are hot springs, and other volcanic phenomena. In the valleys of both are fresh-water lakes—Tiberias in the one and Utah in the other, through which in both cases flow the rivers Jordar, in both cases losing themselves in the salt-water lakes. They closely resemble each other both in area of surface and dimensions of basin. The waters of the two are almost equally heavy, and equally salt, though they differ entirely in the nature of their saline contents, as will be seen below; and they are most unlike each other in matter of depth.

| | Dea Sea. | Great Salt Lake. | Sea Water. |
|---|---|---|---|
| Specific Gravity | 1.22 | 1.17 | 1.027 |
| Mur. Magnesia | 145.8 | ...... | ...... |
| „ Lime | 31 | ...... | ...... |
| „ Soda | 78 | 200 | ...... |
| „ Potash | 6 | ...... | 25 |
| Other Salts | 6 | 20 | 5 |
| | 1000 | 1000 | 1000 |

It will thus be seen, that though in all likelihood the great American lake owes its saltness to the rivers washing away the salt from the rocks around, and carrying it down to be concentrated as in a great salt pan, a like explanation by no means suffices for the saltness of the Dead Sea, whose ingredients are wholly different from those composing rock or common sea salt.

I have confined my observations to the depressions on the surface of the dry land, chiefly dealing with those which were either beneath the level of the adjoining countries, and not filled up with water, or those receding far beneath the surface of the ocean both embosoming lakes in their depths both receiving supplies of river water, but yielding none. The channel of the ocean in the structure and in the diversity of its surface seems in all respects closely to resemble that of the dry land, which has itself, indeed, at no distant period occupied its depths, and still bears on its surface loads of marine remains. Our lesser islands are but the summits of mountains whose bases rest on the valleys or table-lands far down in the main, presenting at times slopes as smooth and gentle, and precipices and cliffs as lofty, rugged, and abrupt as any of those

made visible to the eye of man The sounding-line discloses hills, mountains and valleys, with chasms and recesses as diversified and remarkable as any which the regions exposed to the upper air supply, covered with a dense and varied vegetation, and thickly peopled with numberless races of stirring inhabitants, to some of which in point of size the giants of the superterrene animal kingdom —the elephant, the giraffe, the rhinoceros, and the hippopotamus—are but pigmies. The mean level of the whole solid land above that of the sea is 1,000 feet, —that is, were our mountain masses smoothed down, and our valleys and sea brought up to one general table-land, its surface would be 1,000 feet above that of the ocean. The mean level of Asia is 1,150 feet, that of Africa we know nothing, that of Europe 670, and that of America 930 feet, North America being 750 and South America 1,130. The mean depth of the ocean, again,—that is, of its basin, were this scooped out and smoothed in the floor till it resembled a tank or cistern, is about 2,200 feet, or four miles. It has been measured to the depth of nearly seven miles, or about 36,000 feet, and it covers three-fourths of the surface of the globe. Were the solid part of the earth, therefore, to be removed, and thrown into the sea, the highest mountains would fall short by 10,000 feet of filling up its deepest recesses, and the whole mass would be submerged to the depth of a mile at least.

Vast as these inequalities are when represented in figures, the relation they bear to the diameter of the earth is insignificant. On that magnificent three-feet globe now before you, on which the hand might cover the whole space anything like tolerably known to us, the highest of the Himalayas would be represented by a grain of sand, and the enormous-looking depressions just described by a scratch which would little more than penetrate the varnish—so very small a way beneath the surface does our knowledge extend, and our researches penetrate. Yet this thin film in space furnishes the habitation of all the vegetable and animal tribes that have been formed, and the examination of the minutest portions of it, taxe to the uttermost the intellect, and occupies and exhausts to the energies of man.

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THE Ordinary Monthly Meeting of the Bombay Geographical Society took place at 4 P. M. on Thursday, the 19th October. The following motion and papers were then laid before th e meeting :—

MOTION.—*By Mr. Frere.*—That the Meetings of the Geographical Society take place on the third Thursday of the month to avoid interference with those of the Asiatic Society, which occur on the second Thursday.

Member proposed by Mr Venayekrow Juggonathjee : Mr. Narrayen Dinanathjee.

PAPERS.—On the Chronometrical Survey in 1849-50, by Captain Selby, of the Mud banks off the shores of Bombay, from Kattiawar to Vingorla, with observa-

tions on the water and earthy matter carried out to sea annually from the shores of North Western India, with charts and sections.

On the ordinary instruments employed and methods pursued in Geographical enquiry, illustrated by the exhibition of Instruments. Telescope and other Optical instruments,—Angle measuring instruments,—Levels—the Barometer, Thermometer, Hygrometer, and Rain Gauge—Current measuring instruments—Instruments for obtaining specimens of water from great depths,—mode of constructing maps, of measuring maps, &c., &c., &c.

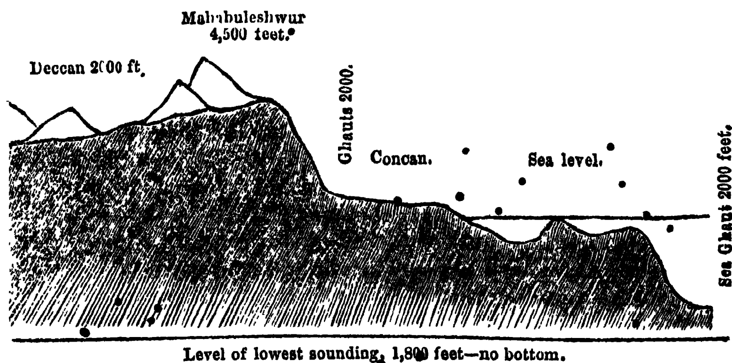
LECTURE III.—*Some Remarks on the Chronometrical Survey, by* Captain SELBY, *of the Shores off Bombay, betwixt Kattiawar and Vingorla, from* 100 *to* 150 *miles out from Shore.* By the Secretary.

The earliest outline we have of Bombay Harbour is that contained in the work of Freer 1681, published in the year 1697, and it seems here worthy of republication as indicative of the conceptions entertained by the earlier visitors of the form of the island. The first really correct chart or map we possess of our Harbour is that surveyed by Captains Cogan and Haines, in the year 1829, and published in 1833. But their surveys only extended some ten miles out ; and we no actual had survey of our shores out to deep water until within these past two years.

Bombay is universally famed as a harbour fit for any amount of shipping; it not only contains safe anchorage, accessible at all seasons, for ten thousand sail of the line, but it may be approached from seaward with the most perfect confidence and safety without astronomical observation, and by the use of the log and lead alone. It will be seen from the following drawings that from 100 to 150 miles from the shore, with which it is nearly parallel, there is a vast step or precipice, a submarine Ghaut, of 2000 feet, which suddenly brings the lead from 50 fathoms water to 300 fms. *and no bottom*: and though so long as he has 170 fathoms water the mariner may feel in perfect security that the land is at least 100 miles away from him, when he suddenly shoals to 50 or 60 fathoms or so, then he may, by the gradual sloping and well defined character and frequent changes of the components of the bank, which fronts the coast of the Konkan from Rutnagherri to Deo, and tails away out from Bombay Harbour, almost track his path by the unaided lead to within sight of the Ghauts or Lighthouse without having seen for days either sun, moon, or star: a peculiarly well marked shoal of about 20 fathoms water 40 miles south of Bombay 30 off the coast of Rajpore bearing the name of "Direction Bank" on the charts and sailing directions. These facts will be made clear from the two reduced Charts at the end of the Number: as they are not intended for nautical purposes, nearly the whole of Lieutenant Selby's figures have been omitted four lines of sectional soundings, at right angles to the shore, corresponding to the sections in Chart II., and three at right angles to these, sufficing for our purpose.

The following curious facts, which the accompanying diagram will better explain, are brought to light:—There must have been a time, by no means

remote, in our geological condition when the higher Ghauts, the Neilgherries, Mahableshwur, Singhur, Poorundhur, Hurrychunderghur, and the like, now from 3,500 to 8,500 above the level of the sea, formed one monstrous group of volcanic islands, spreading out their lavas in those vast horizontal sheets in which we find the bulk of our traps now arranged. It would be much too tedious and intricate here, and lead us to a very remote distance from the simple physical speculation to which we mean to confine ourselves, to follow the geologist into theories, however well established and irresistible they may be, as to the succession of upheavals and depressions, and the various means which must have come into operation to give us the alternate Neptuneau and volcanic deposits we possess; and we may be permitted to suppose that Hindustân, after her first vast volcanoes were developed, rose suddenly or gradually from the ocean to the elevation of from 1,200 to 1,700 feet, giving us the lower scarps of the Ghauts buttressing the table-land of the Deccan. But the great extrusiôn of trappean matter—the vast breach as now appears—neither began at the base of the Ghauts, nor off the shores of the Concan as now existing: along with them was lifted a huge mass of material, which, were a further elevation of 2500 feet to occur, would carry the Concan from 100 to 150 miles to seaward, where it would terminate on the crest of a precipice of 2,000 feet in height.




Level of lowest sounding, 1,800 feet—no bottom.

Were the elevation to be equal in magnitude to that which originally placed the Deccan in its pressent position, then Hindustan would consist of two enormous shelves—the Deccan then 4,000 feet above the sea, the Concan now so called 2,000, with the present ghaut dividing the first from the second, and a second precipice of similar magnitude with now a second Concan separating it from the new ghaut washed at the base by the surges of the Arabian Sea.

Captain Selby has most unfortunately not accompanied his map by any explanation or memoir, this having been forwarded to the naval authorities so that these very imperfect and meagre remarks have been worked out of the document itself.

They have had the benefit of his revision and correction, he entirely concurring in the opinions I have expressed.

In 1849, before we had thought of carrying any survey more than 30 miles to seaward, it occurred to Commodore Lushington then Commander-in-Chief of the Indian Navy, as a matter of much interest, to have the fact investigated as to whether the seas, creeks, and bays immediately around us were not as Bombay Harbour was forty years ago imagined to be, getting silted up—especially when the enormons quantily of solid matter which must needs annually be carried to sea by the Indus, the Saburmuttee, the Nerbudda, and Taptee was remembered so as to be unserviceable for the purpose of navigation. Off the shores of Kurrachee the sea is considerably discolored many leagues from land, while the Gulf of Cambay far southward of Surat seems already thick with mud.

The conclusions come to, so far as navigation was affected, irrespective of this most important one as concerned physics, were that no sensible change had occurred within the present half century in the sea basin—that the colour for eight months of the year of the Gulf of Cambay was due to the turbulence of the tide, the noble streams flowing into it being from November to June pure and transparent as crystal, carrying not a trace of either earthy or saline matter in their bosom.

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[Second Lecture of same Meeting. By the Secretary.]

*On the Instruments mostly employed in Geographical Research.*—This was mainly meant to show how rigid and exact where the processes philosophers pursued before their conclusions could be considered worth anything; and that though they might occasionally be condemned by circumstances to forego observation, and fall back on general estimates, those gentlemen were not entitled to the name of travellers, who took a scamper into a new country, totally unprovided with all the ordinary means and appliances every man might carry along with him, and who come back to tell us that they saw this marvel here, and that marvel there, without being able to give us the slightest notion as to the position where they were seen, or whether they had not been already examined, and only viewed or described under somewhat different lights. The lecture was meant for a popular general audience —its doctrines are so familiar to every geographer as not to require repetition. The following extracts are all that need be given from the Report :—

"The Barometer, or measurer of weight, is an instrument of somewhat greater complexity, and not so easily understood as the thermometer. It is chiefly used by the meteorologist for determining at a given spot the changes of the pressure of the atmosphere and the geographer resorts to it for the ascertainment of his elevation above, or depression beneath, the level of the sea. The atmosphere is a shell of an elastic and transparent substance called air, which surrounds our globe to the thickness, as is supposed of 500 miles ; the fact is impossible of accurate determination, because we have no means of kowing at what rate the air expands itself when all the pressure is removed from it; or to what exent it becomes attenuated in its upper regions. It rests upon the surface of the earth at the level of the sea with a pressure of nearly

15 lbs. on the square inch and our body sustains a load of it of about seven tons over the wholes surface. If I enclose a column of mercury 30 inches in length in a glass tube closed at the upper extremity, so that the pressure of the air is removed from it, and open at the lower to its influence, I find that it will exactly counterpoise or sustain it; and thus a Barometer is formed. A scale is now attached to the other extremity, and for the sake of strength, or ornament, or both, the tube is enclosed in a brass or wooden sheath, and thus stands complete. When the air becomes lighter, which it does before storms or falls of rain, especially in the Tropics, the barometer falls, that is, the atmophere is no longer able to support a column of mercury so long or sustain a load so heavy as before. But the same thing happens irrespetcive of the weather. If I ascend an elevation : the column of air becomes shortened, and diminishes in weight at the rate of half a pound on the square inch every 1,000 feet, and so the mercury falls by one-thirtieth of its whole length, or by one inch ; while, on the other hand, as I descend, it rises a similar fraction. On subdividing the scale into tenths and hundredths of inches, for every hundredth it falls, I as sume that I have descended ten feet, for every tenth a hundred feet, and for every inch a thousand, the converse holding good in the case of ascents.

The Rain Gauge, and its sister the Evaporating Dish are vessels with apertures of very accurately established area ; the former receives the rain that falls, and conveys it into a receiver, from whence it can be measured ; the latter is filled with water, and the quantity carried off in a given time determined. Both represent spaces on the surface of the earth, of their own area, and it is quite clear that if made in all points to assimilate as closely to the surface, desired to be examned, there can be no reason why they should not correctly represent them or why, by knowing how much rain falls, or vapour is carried off from a square foot of space, we should not infer with tolerable exactitude how much ought to be carried off by an acre, a square mile, or square degree, or any given surface, whatever its extent. The thermometer slightly modified comes to assist us in one of these divisions of investigation. The air in its natural state is never perfectly dry, and it requires much care and labour to free it from its moisture ; unless when rain actually falling it is never so thoroughly we tthat it will not take up an additional amount of moisture—the avidity with which it drinks this in is the test of its thirst, a counterpart to this being the reluctance or readiness with which it parts with its moisture. If I take a couple of thermometers, and cover the bulb of the one with wetted muslin, on being exposed to a breeze it will sink below the other in proportion to the celerity with which its moisture is carried off, —this is called the wet and dry bulb thermometer or hygrometer. From this the point may be inferred when dew must be precipitated or rain fall—what is the hygrometric condition of the climate, and what moisture the air holds in suspension. If, again, I insert a thermometer in a vessel artificially cooled, it will be seen that there is a point at which its outer surface, if polished, becomes covered with moisture. The temperature at which this occurs is called the dewing point, as being that at which dew is precipitated. From this, by reference to figure tables, may be ascertained how many grains of moisture are contained in a cubic foot of air—vast oceans of water that are suspended in the form of invisible gas or of visible clouds in the air, with everything that relates to vapour *in situ*.

Though these descriptions are all theoretically correct, and sufficient for enabling the subject to be understood, to go into the minutiæ and refinements that are resorted to to secure accuracy and exactitude would require an hour at least for the description of each instrument. The instruments for measuring angles, of which the chronometer, is a constant adjunct, the telescope an indispensable part, enable us to penetrate into the depths of space, and to measure the size and distance of every object where a base of sufficient length can be found to give the lines proceeding from its extremities a suitable convergence to the point to be determined. With these we track the planets in their paths, and determine the times of their appearance, and lay down with the utmost nicety the courses they pursue through space—with these we follow the comets deep into the recesses of immensity and if we can say but little of the fixed stars by reason of their enormous remoteness, we can assign them a distance the imagination can hardly comtemplate, which the reason assents to, but fails to follow. By these we can tell our position on the surface of the globe, and trace and lay down the continents, islands, and oceans which diversify its surface. With the thermometer I obtain a register of the temperature, and with the hygrometer a record of the moisture of the atmosphere in all its changes, and the barometer gives me not only the pressure of the air, at any given hour at a fixed spot, but enables me to tell when I have ascended above, or descended beneath the level of the sea or of any established position, and how much has been my ascent or descent. With this little mercurial divining rod, scarcely larger or more cumbersome than a walking cane, I can fathom through the depths of the atmosphere, and decide to half an ounce on its surface the amount

of load it bears, and then, plumming down through space, measure the inequalities of the earth's surface. I descend into the Valley of the Dead Sea, and it rises an inch and a quarter above the cut at which it stood on the shores of the Mediterranean, and I know I have descended nearly 1,400 feet: I ascend Mount Sinai, and I find it stands six inches lower than it did at Akaba, and I know that I am more than 6,000 feet above the level of the sea. It indicates to me vast waves of air rolling overhead twice a day two hours before noon and midnight, and it tells me when a hurricane sweeps the Bay of Bengal, 1,200 miles away—noting its approach, and warning the mariner how he may steer out of its path, how turn its outer circles to account in speeding him on his voyage; or how, if too near him, or rushing along betwixt him and the outer ocean, so as to leave no room to manœuvre his ship between it and the shore, he may prepare to meet extremities, and battle as he best may, with the fury of the element he can hope no longer to escape."

For the following I am indebted to Captain Haines :—

"The first plan of Bombay Harbour was, I believe, by Nicholson, an officer of the Marine, in the 18th century. The next was by Lieutenant Court and McClure, H. C. Marine —afterwards corrected by Lieutenant Robinson and Dominicetti. The last Trigonometrical Survey, (1829) was by Lieutenants Cogan and Peters, I. N.—All I had to do with the survey of the Harbour, consisted of a strict examination and survey of the Flag Staff, Middle Ground and other Shoals, and the fixing of the exact positions of the different mooring Buoys."—*Note from Captain Haines, June* 1855.

"One brig and one cutter were employed in 1849 surveying the islands and reefs at the northern part of the Laccadive Group, with the Padua and Sesostris Banks, which latter bank was discovered by the late Capt. Carless in the Hon. Company's steam frigate "Sesostris" on her return from Aden to Cannanore with troops in April 1847. This survey was finished in May, when the whole of the surveying vessels returned to Bombay for the S. W. monsoon, and to refit, after which they resumed their surveying duties; one brig, the "Taptee," with her tender, the "Maldiva," being employed in surveying the various banks off Bombay. The limits of the ground to be sounded over and examined north and south was that comprised between the extreme northern edge of Angria's Bank up to the southern edge of the Malacca Banks, and east and west from the longitude of Bombay lighthouse, in 72° 48′ 56″ east, out to 70° 30′ east. The object of this survey is to furnish ships, as far as possible, with a correct guide for approaching and making the harbour of Bombay, particularly during the thick and unsettled weather that prevails during the S. W. monsoon. This survey is not yet completed, (July 1849.")—*Extract from Captain Montriou's returns—Blue Book*, 1851.

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The Ordinary Monthly Meeting of the Bombay Geographical Society took place on the 16th November, and was unusually well attended. Amongst a large number of ladies and gentlemen who were present, we observed Mrs. Willoughby, Mrs. Boyd, Mrs. Peet, Mrs. Woosnam, Mrs. Erskine, Miss Swanson, Miss Willoughby, Miss Patullo, the Misses Boyd, Sir Henry Somerset, Sir H. Leeke, Colonels Willoughby, Swanson, Brett, and Grant, Majors Glasse, and Woosnam, Rev. G. Cook, Rev. T. Clark, Messrs. C. J. Erskine, J. M. Erskine, J. G. Brown, John Stuart, W. F. Hunter, J. Ritchie, Drs. McLennan, Peet, Giraud, and Bhawoo Dajee, Venayek Row Jugganathjee, Dhunjeebhoy Framjee, Dadabhoy Nowrojee, Ardaseer Framjee, Dossabhoy Framjee, and Messrs. Boswell and Peyton were also present with some of the pupils from their respective establishments.

The following motions and paper were then laid before the meeting :—

MOTION.—1.—That Mr. Adolphe Schlagintweit be admitted Honorary Member of the Society.

2—That a catalogue of the Society's books, maps and charts be printed for the use of members, by itself, or to form a part of the next number of the Transactions—and that the official list of charts and maps published by the

Bengal Government, and that in the Parliamentary return of Mr. Hume be re-printed.

PAPER.—On the late hurricane, with a list of the hurricanes in India generally for the past century, with a particular account of those which have prevailed in the Arabian sea namely, from the 1st to the 7th of November 1783; 1st to 7th of Nov. 1799; 8th of May 1819; 13th November 1827; 15th June 1837; 31st October 1842; 19th April 1847; and 2nd November 1854.

A large collection of maps were exhibited. They were colored in illustration of the meteorology of India. Rain maps for the S. W. and S. E. monsoons. A series of maps illustrating storms of simultaneous occurrence, a map of the hail-storms of India,—a series of the mapsof the hurricanes of 1842, 1847, and 1854, with diagrams of the barometer of eight of our principal hurricanes. Dr. Buist addressed the meeting for about half an hour, premising his lecture with a few observations on the climate of India, and then commenced an exposition of the laws of rotatory hurricanes, and shewed how valuable to navigators were the data furnished by the observations which had been made of cyclones. The lecture was concluded with a brief history of the principal storms which had passed over India during the last two centuries.

LECTURE IV.—*On the Cyclone at Bombay, 2nd November 1854, with the two nights' previous thunderstorms.* By Dr. GEORGE BUIST.

My professional avocations as Editor of the *Bombay Times* compel me to read or at all events to glance at, at least eight newspapers a day on an average, through the year, or, including those from England, Malta, the Cape, Australia, China and Singapore, which come in by dozens at a time, perhaps not fewer than a thousand a month. It has always been my habit to keep copious note-books, especially since I came to India; and from 1846 I have devoted a large volume of 300 or 400 pages annually, to notes on meteorological subjects alone—pasting into it in chronological order all the observatory and other tabular returns, and all the notices pertaining to the weather I could meet in with in the newspapers. Considering that there are only some 8,000 Europeans in India in all, and that of these at least 3,000 are accumulated in numbers at the Presidencies and other large towns, or cantonments, we have a little more than one for every 4,000 square miles of the million and a quarter Hindustan alone contains; and as of these but a small number ever think of writing for the press an account of anything they may have witnessed, however remarkable—a large proportion of our lesser, and many of our more striking meteorological phenomena must pass unnoticed or unrecorded altogether. The nemerous returns, not the less, which do find their way before the world ought, on the mere principle of chances, to afford a tolerably fair average type of the whole; and on this assumption I have proceeded. As most of the papers copy from their neighbours anything very remarkable, when notices of the weather do once get into print, they are not very likely to escape detection in some one of the fifteen or twenty periodical publications in which they are likely to be met.

On carrying out this patching process for some years, I observed that while there were portions of my note-books where the leaves got all at once covered with printed scraps and MS. notes of my own under some particular date, there were others left comparatively blank; and that, moreover,

the crowded and blank spaces seemed after a year or two to make their appearance at fixed and uniformly recurring dates. The assumption was, that if this was shown to hold good for a succession of years, that two sets of remarkable facts must obtain, the determination and the knowledge of which must be of the utmost interest to meteorologists, and of the greatest value to agriculture and navigation.

*1st.*—That there is a class of atmospheric disturbances which occur at certain seasons of the year over large regions of space almost simultaneously; and on these I have bestowed, in contradistinction to the designation Cyclone, or Hurricane, or the local or travelling disturbance, that of "Storms of Simultaneous Occurrence."

*2nd.*—That these storms are not only isochronous, but that they occur at nearly the same time every year.

Since 1849 my hands have been so much more occupied than before, and I have been so frequently disabled by sickness, that though I have never I think suffered an observation to escape me unregistered,—and the mass of matter thus systematically stored away, begins to assume an appearance almost alarming—I have never been able to make use of it as desired in any published or publishable form; and I avail myself of the opportunity the discussion of the storms of the last two nights of October, and the hurricane of the first two of November last, affords me, of bringing my views on these subjects before the world, crude and immature as they are, in hopes of securing the assistance of other meteorologists in the prosecution of a task one can hardly hope to accomplish single-handed. I am far from setting forth the doctrines already broached as anything like established; but I think I have got evidence sufficient, so far at least as India is concerned, to make out a strong presumption in their favour—their confirmation or refutation must be the work of time. The following examples will illustrate the manner in which the investigation was for a time pursued:—Large maps of India were got prepared on purpose, and on those all the storms of which accounts had been obtained were washed in in green; storms of wind were indicated by arrows, hail by blue dots and thunder by zigzags of red. The extracts I have given below were printed on the corners of the maps, and at the bottom were three ruled chequers for the barometer—the first and last chequers narrow, representing a single day. On the first of these the curved diagrams for the month when the storm occurred, from all the Observatories where hourly registers were kept, that could be obtained, were given; on the other the means of the year; thus indicating the extent of departure from the ordinary type of pressure both monthly and yearly, that had occurred. The principal diagram, placed between these two,—the three filling up the breadth of the map,—afforded chequered spaces for a succession of five days' hourly readings, from every quarter whence reliable information could be obtained laid in in distinct colours; this being the extreme period over which this class of storms was, at most, ever found to extend. The whole presented at a glance a general idea of the space and number of points through Hindustan where these storms had occurred, always to be taken with the qualifications already set forth in reference to the paucity of observers and points of observation, compared with the vastness of the regions from which information was desired; while the letter press gave the same thing in figures and indicated the authorities on which the whole was given.

In the Appendix, I shall endeavour to give a list of our first week of November storms, such as I have not yet had time to prepare. I have omitted

them all in the subjoined examples and given those of the other portions of the year instead. It must be observed, that a disturbed, troubled, and cloudy sky, an unusual condition of the wind, and an uneasy aspect in the air altogether, is held to be an atmospheric disturbance, though no actual outburst of thunder, wind, or rain may have occurred, such as may have been experienced before at the corresponding dates or may be occurring simultaneously with those in other quarters of the country.

[The Extracts from the journals have been curtailed to save space—what are here given will suffice as specimens.]

CRISIS OF 15TH JANUARY, 1849.

"The weather at Bombay had little more than steadied itself from the slight disturbance of the 8th, and the instruments recovered their usual course, when on the 15th January a very notable crisis occurred,—a storm having burst out over the whole of India. On the 14th the barometer, which for the previous five days had stood unusually high, suddenly began to fall.

On Saturday the 13th Jan., the whole sky as evening advanced was covered with a film of cloud. Throughout Sunday 14th, showers felt over the southern half of the island ; and from 4 to 6 A. M. on Monday it rained heavily all around —upwards of half an inch having fallen. The wind blew strong on Sunday till past 3 P. M. from S. E. : it then shifted round to S. W. and lulled. On Monday (15th) forenoon it was strong from N. Ely., and the sky troubled and clouded all over. The thermometer had meanwhile dropped from 85 to 68°, and the air felt chill, damp, and uncomfortable. On Monday night the sky towards the zenith cleared up, and the stars shone out with the utmost brilliancy. Clouds continued piled all around the horizon. The thermometer unprotected sunk in the course of the night to 58°—that in the verandah to 65° ; the barometer springing up, almost as rapidly as it had fallen, nearly to its ordinary altitude. The general direction of the wind was northerly; it blew chill, damp, and disagreeable. On the 16th a thin film of vapour continued to veil the sky throughout the day. The disturbance seems to have occurred exactly at the same time all over India, from the base of the Sooleiman mountains to Madras. It rained violently at Mooltan, on the Jhelum, and at Lahore, on the 13th, 14th, and 15th. At Umballah it blew hard on the 14th, and a smart fall occurred on the day following. On the 13th, 14th 15th, and 16th, it rained violently at Delhi, Agra, Gwalior, and Allyghur, and all over the North Western Provinces, giving fine promise of a noble rubbee crop. In the Jetch Doab violent rain fell on the 14th. A severe hail and thunder-storm occurred at Jaulnah on the 14th, where five people, with many animals, were killed by the electric fluid. The pieces of hail were mostly flattened spheres, or lens-formed : they were from two to two and a half inches in diametre, some of them filling the mouth of a claret glass : they weighed from one to two ounces each. Branches of trees were broken, the roofs of houses penetrated by them, and many men, oxen, and sheep, killed by them, in the field. The same thing to a less extent was experienced at Aurungabad. It spread over all Candeish. At Deesa a violent thunder-storm occurred betwixt two and four o'clock on the afternoon of the 14th, with hail, and a heavy fall of rain. Here as at most other places, it was followed by intensely cold clear weather : the wind during the storm was south-easterly. At Kurrachee there were some smart shower on the afternoon af the 14th,—thick unnatural-looking weather having been felt all over Scinde. The centre of the storm, so far as we can discover, was somewhere not far from Jaulnah, where it was experienced in its greatest violence. There was thick weather with some rain at Surat, Poona, and the Mahabuleshwar Hills. At Belgaum there had been a smart shower on the 8th ; and at Madras, at Trevandrum, and at Cochin, where there is scarcely any rain in Jan., heavy showers with stormy whether had prevailed from the 8th to 14th.

On the 15th a remarkable cloud was seen at Bombay to stretch from about 30° horizontally along the south horizon bout 10° just after sunset. The sky was intensely blue, cloud pale orange, breaking off suddenly at the western extremity, and leaving a jagged fracture. Here a sunbeam struck, and, after yielding the most beautiful fragment of rainbow, was thrown up in the air.

The following tables give corrected the state of the barometer at all the stations from which trustworthy observations have been received :—

BOMBAY. Lat. 18° 55′ N., Long. 72° 52′ E.

| | 12th. | 13th. | 14th. | 15th. | 16th. | 17th. | 18th. | 19th. |
|---|---|---|---|---|---|---|---|---|
| Maximum. | 30·029 | 29·960 | 29·920 | 29·935 | 30·027 | 30·059 | 29·969 | 30·0'8 |
| Minimum. | 29·892 | 29 810 | 29·784 | 29·790 | 29·914 | 29·906 | 29·842 | 29·901 |
| Range...... | ·137 | ·150 | ·136 | ·145 | ·113 | ·153 | ·127 | ·117 |

CALCUTTA. Lat. 22° 41′ N., Long. 88° 27′ E.

| | 12th | 13th | 14th | 15th | 16th | 17th | 18th | 19th |
|---|---|---|---|---|---|---|---|---|
| Maximum. | 30 135 | 30·101 | 30·100 | 30·140 | 30·104 | 29·987 | 29·954 | 30 096 |
| Minimum. | 30·024 | 29·954 | 29·968 | 30·004 | 29·998 | 29 861 | 29·871 | 29·988 |
| Range...... | ·111 | ·147 | ·132 | ·136 | ·106 | ·126 | ·083 | ·098 |

HOSHUNGABAD. Lat. 22 41′ N., Long. 77° 42′ E.

| | 12th | 13th | 14th | 15th | 16th | 17th | 18th | 19th |
|---|---|---|---|---|---|---|---|---|
| Maximum. | 29·083 | 29·052 | 28·906 | 28·898 | 28·989 | 29·012 | 28·965 | 29·092 |
| Minimum. | 28·904 | 28·893 | 28·787 | 28·751 | 28·813 | 28·876 | 28·844 | 29·932 |
| Range...... | ·179 | ·159 | ·119 | ·137 | ·166 | ·136 | ·121 | ·060 |

FUTTEGURH. Lat. 27° 21′ N., Long. 79° 31′ E.

| | 12th | 13th | 14th | 15th | 16th | 17th | 18th | 19th |
|---|---|---|---|---|---|---|---|---|
| Maximum. | 29·602 | 29·545 | 29·467 | 29·560 | 29·467 | 29·487 | 29·388 | 29·433 |
| Minimum. | 29·557 | 29·433 | 29·354 | 29·388 | 29·388 | 29·433 | 29·365 | 29·545 |
| Range...... | ·045 | ·112 | ·113 | ·172 | ·079 | ·056 | ·023 | ·112* |

ADEN. Lat. 12° 46′ N., Long. 45° 15′ E.

| | 12th | 13th | 14th | 15th | 16th | 17th | 18th | 19th |
|---|---|---|---|---|---|---|---|---|
| Maximum. | 29·966 | 29·922 | 29·893 | 29·878 | 29·918 | 29·901 | 29·874 | 29·917 |
| Minimum. | 29·818 | 29·806 | 29·797 | 29·728 | 29·784 | 29·749 | 29·776 | 28·824 |
| Range...... | ·148 | ·118 | ·096 | ·150 | ·134 | ·152 | ·098 | ·093 |

CRISIS FROM THE 13TH TO THE 15TH JANUARY, 1849 WITH PLACES FROM WHICH RETURNS HAVE BEEN RECEIVED.

| | Lat. N. | Long. E. | Alt. Feet. | |
|---|---|---|---|---|
| Jhelum ...... | 33·00 | 73·50 | | Rained heavily for three days. |
| Chenaub ...... | 28·54 | 70·30 | | ditto ditto ditto. |
| Lahore .......... | 31·35 | 74·18 | | Rained during the 13th, 14th, and 15th. |
| Mooltan ...... | 30·18 | 71·42 | | Rained heavily on the 13th, 14th, and 15th. |
| Ferozepore ... | 30·50 | 74·35 | | Heavy rain fell at Ferozepore—0·05 on 14th, and 1·00 inches on 15th. Wind S. E. |
| Sukkur.......... | 27·40 | 68·54 | | Cloudy suspicious-looking weather. |
| Kurrachee ... | 24·55 | 67·02 | Sea. | Smart showers at Kurrachee betwixt the 13th and 15th. |

* In this case the afternoon minimum was in reality greater than the morning maximum.

| | Lat. N. | Long. E. | Alt. Feet. | |
|---|---|---|---|---|
| Simla ......... | 31·60 | 77·90 | 6000 | Very heavy rain betwixt the 13th and 15th, over all the N. W. Provinces, giving assurances of a first rate rubbee crop. |
| Delhi ......... | 28·35 | 77·12 | 800 ? | |
| Meerut ......... | 29·09 | 77·38 | | |
| Agra ............ | 25·00 | 80·30 | | |
| Allahabad ..... | 25·28 | 81·41 | 500 ? | |
| Gwalior ...... | 26·20 | 78·03 | | |
| Allyghur ...... | 28·12 | 78·00 | | Very heavy rain at Allyghur. |
| Jaulnah ...... | 19·51 | 76·01 | | Furious hail and thunderstorm—many people killed: hail the size of billiard-balls on 14th. |
| Aurungabad... | 19·55 | 75·20 | | Ditto, less violent. |
| Deesa ......... | 24·18 | 72·12 | | A severe thunderstorm occurred on the 14th—it had prevailed over the whole of Candeish. |
| Bombay ...... | 18·55 | 72.52 | Sea. | On the 14th, showers fell over the greater part of the island. On the 15th it rained heavily all round. The barometer fell considerably. |
| Calcutta ...... | 22·41 | 88·27 | Sea. | At Calcutta the barometer continued extremely high till the 17th, when it fell suddenly by more than ·1, and heavy showers occurred |

## Crisis from the 20th to the 23rd February, 1849.

From the 1st to the 12th February the Barometer had with one exception (the 2nd, when it fell to 29·993 and 29·869) maintained its maximum above 30·000. On the day last named it fell to 29 977, and so continued at nearly this till the 17th, when it once more rose to 30 009, and then fell next day to 29·797, minimum (maximum not given being Sunday, but probably 29·927.) From this time it kept very low, and the following are the readings that have reached us from the 18th to the 25th :—

The following tables give corrected the state of the Barometer at all the stations from which trustworthy observations have been received :—

**Bombay.** Lat. 18° 55′ N., Long. 72° 52′ E.

| | 18th. | 19th. | 20th. | 21st. | 22nd. | 23rd. | 24th. | 25th. |
|---|---|---|---|---|---|---|---|---|
| Maximum. | 29·901 | 29·901 | 29·890 | 29·904 | 29·895 | 29·891 | 29·926 | 29·969 |
| Minimum. | 29·797 | 29·779 | 29·775 | 29·791 | 29·799 | 29·734 | 29·804 | 29·848 |
| Range.. ... | ·104 | ·132 | ·115 | ·113 | ·096 | ·157 | ·122 | ·121 |

**Calcutta.** Lat. 22° 41′ N., Long. 88° 27′ E.

| | 18th. | 19th. | 20th. | 21st. | 22nd. | 23rd. | 24th. | 25th. |
|---|---|---|---|---|---|---|---|---|
| Maximum. | 29·925 | 29·756 | 29·781 | — | — | 29·840 | 29·841 | — |
| Minimum. | 29·766 | 29·591 | 29·642 | — | — | 29·751 | 29·749 | 29·756 |
| Range.. .. | ·159 | ·165 | ·139 | — | — | ·089 | ·092 | — |

**Hoshungabad.** Lat. 22° 41′ N., Long. 77° 42′ E.

| | 18th. | 19th. | 20th. | 21st. | 22nd. | 23rd. | 24th. | 25th. |
|---|---|---|---|---|---|---|---|---|
| Maximum. | 28·931 | 28·902 | 20·782 | 28·830 | 28·827 | 28·793 | 28·881 | 28·989 |
| Minimum. | 28·699 | 28·612 | 28·573 | 28·697 | 28·633 | 28·657 | 28·828 | 28·852 |
| Range.. ... | ·232 | ·290 | ·209 | ·133 | ·194 | ·136 | ·053 | ·137 |

**Futteghurh.** Lat. 27° 27′ N., Long. 79° 30′ E.

| | 18th. | 19th. | 20th. | 21st. | 22nd. | 23rd. | 24th. | 25th. |
|---|---|---|---|---|---|---|---|---|
| Maximum. | 29·332 | 29·152 | 29·140 | 29·163 | 20·152 | 29·174 | 29·287 | 29·354 |
| Minimum. | 29·163 | 29·107 | 29 084 | 29·163 | 29·084 | 29·129 | 29·253 | 29 320 |
| Range.. .. | ·169 | ·045 | .056 | ·000 | ·068 | .045 | ·034 | ·034 |

Aden. Lat. 12° 45′ N., 45° 14′ E.,

| | 18th. | 19th. | 20th. | 21st. | 22nd. | 23rd. | 24th. | 25th. | 26th |
|---|---|---|---|---|---|---|---|---|---|
| Maximum. | 29·851 | 29·790 | 29·846 | 29·888 | 29·881 | 29·822 | 29·806 | 29·839 | 29·845 |
| Minimum. | 29·779 | 29·709 | 29·703 | 29·765 | 29·788 | 29·733 | 29·741 | 29·728 | 29·761 |
| Range.... | ·072 | ·081 | ·143 | ·123 | ·093 | ·089 | ·065 | ·111 | ·084 |

It will here be observed that the 22nd was not only one of very great maximum depression, but, what is always a sign of troubled weather, of very small daily range : the mean ·847, as deduced from half the maximum and minimum, is greater by ·039·5 than that of the 23rd—29·807·5. The same heavy mists which had prevailed from the 6th still continued. The land-wind prevailed over the morning and blew round by south—the vane making a complete revolution. In its usual state it lulls into a dead calm betwixt the blowing of the land and sea-breezes. At Calcutta the heat was most oppressive. There was a heavy sea at Saugor and in the channels below,—the wind blowing from S. W. The pilots began to imagine that the rainy season, which does not usually commence till May, was setting in. At Comillah, in the Tipperah Zillah, 23° 28′ N., 82° E., 200 miles from Calcutta, a furious storm raged on the 19th. At Chittagong there was a severe gale of wind from S. on the 19th, 20th, and 21st, which ended in a storm of thunder and lightning, with a heavy fall of rain. At Madras, the barometer went down on the 22nd so low as to indicate an atmospheric disturbance at no great distance. The appearance of flying scud from the west the following day appeared to indicate the Malabar Coast as the scene of perturbaton.

Comillah.—A native correspondent informs us that on the night of the 19th Feb., the country around the station of Comillah, (lititude 23° 28′ north of Tippera,) was visited with a terrific hurricane accompanied by rain.—He says : " In purgunnahs Cudwa and Mehercool, the former about twelve miles south, and the latter six miles north east, of Comillah, the storm raged for four hours. The loss of human life in the pergunnahs is estimated at thirty killed, and forty severely injured ; more than two-thirds of the houses of the inhabitants and a large number of their cattle were also destroyed. Several large trees were torn up by the roots and thrown about three miles from their sites. On the morning after the storm the body of a woman of Chukustah was found in her compound, but her head was lying in a field about a mile from her house ; the corpse of another woman of the same village was found on a tree near her house ; a dead cow was perched on a palm tree ; two male heads were likewise found in a large tamarind tree, which had been rooted up and carried to a considerable distance from its place of growth. A report has also reached me that many of those who were injured are likely to die. I have never before heard of such a hurricane, except that which occurred in 1837, and the effects were felt severely in the districts on the Bhaugiruttee, but the hurricane did not then work so miraculously as in the present instance." Miraculous, in truth, if it contrived to blow a woman's head off.—*Friend of India, March* 21.

Chittagong.—The following we extract from a letter from Chittagong, dated 22nd Feb :—" Mr. Piddington, as well as some of your other readers, may be interested to know that on the 19th 20th, and 21st, we had a severe gale of wind here from the south, which ended in a storm of thunder and lightning, with an ample allowance of rain. The season has altogether been a remarkable one. In October, during the springs at the full moon, the tides rose about 2½ feet higher than has been known for forty years. The crops on all the low lands up and down the coast were destroyed, and the late Commissioner, Mr. Rickett's last act was to recommend a remission of revenue in consequence to the extent of about a lakh of rupees—rather unpalatable at present I guess. In each of the three following months we had heavy rain, and now our southerly winds and wet weather seem to have commenced, which is a month or six weeks earlier than usual. The Madras

troops here are keeping more healthy than the Bengalees used to be, but not so the rest of the regiment at Khyouk Phyoo, where both officers and men are suffering much from fever."—*Calcutta Englishman, March* 4.

BENGAL.—It appears that during last week there was some very boisterous weather and a heavy sea at Saugor and in the channels below. It was blowing hard here at the time from the south west. Such weather is very unusual in February: but both here and on the other side of India the season has been very remarkable. The S. W. monsoon is not generally considered to commence fairly, or rather foully, till the beginning or middle of May; but last week some of the pilots thought the monsoon had set in—full two months earlier than usual! We have since had some northerly wind, and the weather has been so hazy that all Monday 26th, and yesterday, there were no semaphoric reports.—*Hurkaru Feb.* 28.

HOSHUNGABAD.—On the 20th February, half a gale had blown throughout the greater part of the day, the mean of the barometer having descended in three days from 28·949 to 28·684! Our correspondent continues:—"Prognosticating an earthquake at Hoshungabad is somewhat akin to a pig seeing the wind, but I only hint at such a phenomenon from the consciousness that there is something very peculiar just now in the atmosphere, and from the fact that the instruments seem as strangely affected as the senses."—*Bombay Times.*

MADRAS.—From our Meteorological Observations the few following notations are culled. During last week some attention was called to atmospherical variations. The thermometer was observed to be at 84° ; rather higher than usual in February; and it accompanied (as some times observable) a depression of the barometer. This depression was not greater than customary when the south west wind regularly sets in, as it did last week. But on Thursday last (22nd,) the barometer went down so low as to indicate atmospheric disturbance at a distance from Madras. The appearance of clouds, and flying scud from the south west, on Friday seemed to point out the Western Coast as the probable site of a gale. The bright appearance in the low horizon, in that direction, has been a little singular; and we may perhaps hear of bad weather from the other coast. For a fortnight past the state of the sky has been not a little remarkable. We have no Cyanometer; but without it, can state that the blueness of the sky has been less than usual, with an almost whiteness by day, and haziness by night around the horizon—indicating that the atmosphere is loaded with highly rarified vapours. The barometer has again risen, and we can have no immediate apprehensions. However the track of the approaching lunar eclipse will be on the west of the parallel of Tranquebar, or thereabouts, and the solar forces drawing southerly. So that we are not perfectly secure against a possible gale, from Ceylon northerly, perhaps as far as Madras, though nothing serious is to be apprehended. Seamen however may be cautioned to keep a good look out; and every thing as snug as possible. It is seldom possible to assert with precision that such and such thing will occur; and we do no more than hint at a possibility now, because we can see only dubious indications.—*Circulator, Feb.* 28.

THE PUNJAUB.—The orders to march were issued at an early hour on the 22nd of February, and the troops marched about 8 A. M., and kept up the pursuit for 18 miles, under a hot sun, and through a jungly country in the direction of the Khoree pass. During the night a heavy storm came on. The same storm appears to have ranged all along the outer range of the Himalayas, as it extended to Mussooree, and was felt here in the masses of dust that filled the air for two or three days after the 24th. On the 23rd, the march was resumed, and the force reached Khoree, the position which the Seikhs occupied in such force after having evacuated Russool. A hail-storm occurred as the troops were passing up the defile, and rain fell in torrents for some time after their arrival at Pooran.—*Delhi Gazette.*

This is merely a specimen of the plan of inquiry and publication originally contemplated; and I had at this date, nothing but the Observatory reports,

the newspaper extracts, and my own observations to assist me. From the time I applied to Government for returns from the regimental hospitals, and other quarters where registers are kept, a vast mass of information accumulated on my hands, of which I have hitherto only been able to make a partial use. I regret to say that this consists merely in thermometric and pluviometric readings, much of it obviously but little to be depended on. The barometer is scarcely anywhere in use, and the most valuable of all meteorological observations, the remarks on the general character of the weather, and aspect of the sky, without reference to instruments at all, is almost invariably withheld.

Reams and reams of returns, such as these are to be found in the archives of the Medical Board, and in other offices, which, as they are rarely given in any shape to the world, and have never been submitted to the inspection of a meteorologist, might just as well have been left unmade. In some of those published by authority under the charge of departments where care and accuracy might have been looked for, we find the processes of tabular reduction bestowed on observations which at a glance may be seen to be utterly erroneous: publications for our guidance, if made use of at all, only leading the meteorologist astray.

*The Gunpowder Plot Storms of* 1854.—The thunderstorms of the first week of November, have so frequently occurred about the 5th, that I have given them the designation of the "Gunpowder Plot Storms." The term was this season a misnomer, they having occurred, not in November, but October.

But that the weather of the whole of the latter months of 1854, was so anomalous and unusual in its character, we should have said that the atmospheric disturbance about to be described gave manifestations of its approach so early as the 25th, when the sky began to get cloudy and troubled, and the barometer to fall. The following evening there was sheet lightning with massive thunder clouds in the S. E., both, as is usual, vanishing as it became dark. The displays of lightning continued to increase, and on the 27th, it was accompanied by thunder. On the 28th from 7 till 10 P. M., there was a magnificent halo round the moon, about 10° from her disc—the circle was white without irridescence, and nearly perfect in its form. On the 29th, 30th, and 31st our thunderstorms prevailed, that of the 30th being particularly magnificent. It passed right over Bombay, the lightning striking one of the poles of the electric telegraph, and fusing a considerable portion of the wire. For more than three hours the roar and rattle of the thunder, and blaze of the lightning was almost incessant. Two storms seemed to rage simultaneously—one in the E., another in the N. W. These storms were felt with peculiar violence on the 29th and 30th, on the S. and S. E. of us. Fierce blasts of wind, and showers of rain occurred on all the three nights. At Madras a strong southerly wind prevailed, and heavy rain fell. Off Pondicherry there was a severe storm in the Bay of Bengal, and it prevailed all along the Malabar Coast with more or less intensity, and was peculiarly violent about 300 miles to the S. Rain fell at Bangalore, and violent gales were experienced at Poona. On the 31st October and 1st and 2nd November, there were heavy falls of rain around Agra, a thing unusual at this period of the year.

When we take into account at the same time that this is the date of the setting in of the Madras stormy and rainy season, so that the disturbed state of the weather to the S. E., of us might have been looked for, our returns are either more defective, or those disturbances were much less general this season

than usual. The barometer at Bombay fell about ·100; at Madras and Calcutta seems to have been unaffected.

*The Bombay Cyclone of 1st and 2nd November.*—The general phenomena and theory of Cyclones, have been so patiently and thoroughly investigated, and are now so perfectly understood, that carefully as our Bombay gale was watched, it scarcely at all adds to our stock of information, unless in affording us an instance of a revolving hurricane—in all other respects obeying the customary laws,—occupying a space and a period of time limited without example when compared with its violence and the destruction it occasioned while it raged.

As it was the only thing of the kind I had ever experienced, I watched with peculiar care, not only the signs of its approach, and meteorological phenomena it presented while it prevailed, but have noted many circumstances, connected with its consequences, and especially its influences on the vegetable kingdom such as have not so far as I know hitherto been noticed by cyclonologists.

Considering the frequency of hurricanes in the Bay of Bengal and the China Seas north of the line, to the east of us, and the seas around the Mauritius and towards the Cape, it is singular how rarely they get northward of Ceylon on the western shores of India, or visit the Arabian Sea. In the former localities cyclones make their appearance about once a year, in the latter not once in ten.*

The foul weather with which we are occasionally visited in the fair season scarcely ever lasts longer than three days, and the burst and final clearing up are generally marked and unmistakeable. The 1st of November dawned upon us with a troubled sky, an intensely moist atmosphere; and, most suspicious of all, the wind blew from the south, the direction from which it most rarely reaches us, unless for a few days at the setting in of the rains. The sky was covered with a sheet of leaden coloured, feathery fashioned clouds, not corresponding to any of those contained in our ordinary nomenclatures; and these continued fluttering unceasingly and tumbling over each other in small flakes to leeward in a manner not capable of description, but which I have always observed to be followed by gales of unusual violence.

The feeling of every inanimate as well as of every animate thing,—if the former could be conceived endowed with sensation,—seems on these occasions that of discomfort; nothing looks as it ordinarily does; and there appears amongst the brute creation a kind of general though unexpressed apprehension of something calamitous being at hand. These symptoms, which prevailed from dawn, continued to increase as the day advanced: the occasion was one on which I was unfortunately unusually occupied with a fellow-labourer anxious for the completion of our common task, for which the press was already waiting; so that I did not once till after dark examine the barometer. The signs of storm were such as caused me to put, early in the afternoon, a very flimsy dwelling-place, then open in several places, from being under repair, in the best state of defence I could, and so successful was I in

* In the appendix will be found a list of hurricanes which have taken place within the century betwixt the meridians of the Cape and Ceylon, and within the Tropics. In its best state it will be found extremely incomplete, though less so than any that has hitherto been published: it was prepared for the text, but has been postponed to the appendix in hopes that a little additional leisure might allow of its improvement.

this that it suffered less than dozens of tenements of the most substantial description.

As from henceforth Colaba and Sewree will come frequently to be mentioned, I may here explain that by the former is meant the Government Meteorological Observatory, adjoining the Lighthouse, near the southern extremity of the island of Colaba; by Sewree the name of a large and well-known fishing village, my own residence (Balcairn) close by which is about nine miles N. E. from the Observatory—both of them overlooking and adjoining the beautiful creek which constitutes Bombay Harbour. The Observatory is about three miles S. W., Sewree somewhat more than five miles N. E. of the Fort and Dockyard. These explanations may assist those not familiar with the general topography of Bombay much beyond the anchorage, the roadstead and harbour, the case with most navigators,—to comprehend the description about to be given.

About nine o'clock the storm and squalls became more violent and continued to increase till half past twelve, when all at once the hurricane burst on us in its strength from S. E. by E. It continued pretty constantly from this direction till about half past two, up to this time increasing in strength with a great quantity of rain. About four it slackened considerably and veered round to S. and then into S. W. when as day dawned it burst upon us from this direction with very much greater fury than it had blown from the other side of the circle. It was now loaded with sheets of rain which made the face smart like small gravel, it continued thus for about three-quarters of an hour, changing its direction slightly to S. W. by S. and S. W., and a little after seven o'clock and before getting further round, it suddenly lulled to a moderate monsoon breeze. About nine it shifted back again into W. and then W. by S., not having completed the circle, these last winds being eddies merely, and rained heavily till about half past ten, when it faired up and the day became fine, exhibiting in the mild sunshine, in all its desolation the havoc a few hours of tempest had wrought.

The following very valuable remarks and tables were issued from the Observatory the second day after the hurricane.

### *The Thunder Storms of the 29th and 30th October.*

"About Noon on Sunday the 29th October, although the day was remarkably fine, we observed a slight fall in the Barometer, and the temperature of the air to be slightly increasing : awkward suspicion of a coming storm, and particular attention was directed towards the E. horizon. in which direction storms at this time of the year generally arise. About 1 P. M a few patches of light cumuli were observed to be rising in the E and S E horizon ; these went on increasing and mingling until about 4.0. P M., when they exhibited electrical cumuli ; and behind them was a low ridge of darkish feathery clouds stretching from the N N E to the S horizon. As the evening advanced, these clouds concentrated in the S E, and rapidly overspread the whole of the E. hemisphere—the sky to the W. was clear, except in a few places. At 5.39 P M rain fell ; and low murmurings of distant thunder were heard, and sheet lightning became visible in the N E. At 4.50 the wind went round from N W by the N. to S E by S, and at 6.0 P M was S ; from this it returned back (by the E) to N by W at 7.0 P M. From 5.50 to 6.30 the thunder and lightning gradually approached from the N E towards the zenith ; the flashes of lightning were incessant, and the thunder was one continuous roll. At 6.30 the storm had reached its greatest intensity, and the wind blew in strong gusts (4.00lbs.); accompanied with heavy rain. From this

time the storm quickly moderated, and finally, after passing N of the zenith, disappeared by 8.0 P M in the W N W.

The thunder and lightning storm which occurred on the evening of the 30th October, was nearly a recurrence of that which took place the evening before; with this difference, that it arose in the E S E at 4.0 P M, and did not finally disappear until 9.0 P M. In all other respects it exhibited the same phenomenon, and followed the same track as that of the 29th.

On the 31st October, the sky was overcast with nimbi clouds; and from 4 0 P M. to 8.0 P M. distant thunder was heard, and sheet lightning was visible principally in the N N E and S E horizon. The wind was S W from 2.0 P M till 5 0 P M. when it went on to S, where it remained till 7.0 P. M., then went on the E., remained between E and N E up to 11.0 A M on the 1st November.

*Hurricane on the night of the 1st, and morning of the 2nd.*

During the day, the sky was overcast with nimbi in two strata. From 6 A M to 2.0 P M. there was a continual light drizzling rain; and the wind remained steady at E by S, with a gradually increasing force. The Barometer arrived at its minimum at the usual time, 4.0 P M. we read 29.532, being only about 0.060 less than what it indicated the day before. It arrived at its night maximum (29.665) at 8.0 P M. being nearly an hour and a half before the usual time, whence it rapidly descended and at midnight it fell 0.165. By 2.0 A M. it had fallen 0.248; and at 4.0 A M. it obtained as to time, its regular morning minimum, having fallen from its night maximum 29.662 to 29.183, being nearly 0.450 inches of descent in eight hours. From 4.0 A M. on the 2nd it rose rapidly to 29.762 at 11.0 A M, a rise of 0.581 inches in seven hours, but an hour later as to its usual time of maximum in the morning.

At midnight the wind veered from S E by E to S E and rapidly increased in force from 15lbs. pressure, on a square foot of surface, till 3.0 A M on the 2nd, when it inclined a little more towards the S and increased in force to 35lbs. At this time the roaring of the sea and wind, the noise of falling tiles, and the crashing of the larger branches of the trees, as they fell about the Observatory, together with the intense darkness, was truly awful. At 4.0 A M the wind was still raging in all its fury and with the same force, but shifted to S by E, and at 4.30.* the storm lulled and went on to W S W moderating a little; at 5.0 A M it went on to W, still moderating. At 6.0 A M it was W N W and rapidly decreased in violence, from this time till 9 A M it gradually subsided, and by 9.0 A M, when heavy showers of rain fell, all trace of the Hurricane disappeared.

When day broke on the morning of the 2nd November, the scene of devastation that the compound of the Observatory presented was really appalling; the most of all the trees in the compound were rent, as if torn by some gigantic hand; palings were blown away and strewed all over the place. In the Superintendent's dwelling, the eastern verandah had its furniture, such as tables, chairs, &c, blown from one end of the verandah to the other; mat frames were unhooked and blown away; two substantial canvas screens were blown to rags; and some glass doors and venetians were torn away from their wooden sills. Here and there on the sea-beach in front of the compound, might be seen spars and fishing stakes which were washed ashore. A large banian tree near the Observatory well, which had stood the hurricane of 1837, was not torn up by the roots, but its trunk was rent and twisted in the centre as if it had been a mere twig.

* This was the centre of the cyclone passing overhead.

*Observations from 5.0 P. M. on the 29th October to Noon on the 2nd November 1854.*

| Bombay Civil Time. | Standard Barometer corrected to 32° Fhr. | Thermometers. Thermometer in the air. | Thermometers. Wet-bulb Thermometer. | Depression of Wet-bulb Thermometer. | Wind. Direction. | Wind. Force in lbs. per square foot of surface | Rain in Inches. | Electrometer. Straw Electroscope. Volta No. 1. | Electrometer. Straw Electroscope. Volta No. 2. | Electrometer. Straw Electroscope. Henly's. | Electrometer. Ronald's Spark measure. Length of Spark | Electrometer. Ronald's Spark measure. Corresponding frequency. | Extent of cloudy sky the whole sky.—8. | State of the Weather. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 29th Oct. H. M. 5 0 p. m. | inches 29·735 | ° 84·6 | ° 78·5 | ° 6·1 | S E. by S. | lbs. 0·10 | None. | 1 | | ° | | | 7 | Electrical Clouds piled along the horizon ; from N. E. to S. E. ; Nimbi scattered moving S. W. ; Cirrostrati in the W. horizon ; rain at 5 h. 39 m. ; and thunder and sheet lightning in the N. E. at 5h. 50m. |
| 6 0 | 736 | 82 8 | 78·0 | 4·8 | S. | 4·50 | 0 02 | Out of Scale | Out of Scale. | 10 | 0·1 | Instantly. | 8 | Overcast with Electrical clouds ; vivid lightning and loud peals of thunder in the N. E. at intervals of 50s. ; gusts of wind and drizzling rain. |
| 7 0 | 757 | 75·9 | 74·7 | 1·2 | N. by W. | 0·50 | 0·33 | ... | ... | 7 | 0·2 | Ditto. | 8 | Overcast ; vivid lightning and loud peals of thunder in the N. W. and W. ; a terrible crash of thunder in the Zenith ; the storm has passed N. of Zenith to the N. N. W. ; heavy rain. |
| 8 0 | 770 | 79·1 | 76·0 | 2·1 | N W by N. | 3·00 | 0·03 | ... | .. | 7 | 0·1 | | 8 | Overcast with Nimbi, very dense in the N. and W. ; faint flashes of lightning in the West horizon. |
| 9 0 | 763 | 78·3 | 77·5 | 0·8 | ... | Calm. | None. | ... | .. | 2 | None. | | 8 | Overcast with Nimbi in two strata ; no lightning visible. |
| 10 0 | 763 | 78·2 | 77·0 | 1·2 | .. | ... | ... | 2 | 0 | | 0·0 | | 8 | Ditto ditto ditto ; ditto ditto. |
| 11 0 | 760 | 78·0 | 76·5 | 1·5 | .. | ... | .. | 2 | 0 | | 0·0 | | 8 | Ditto ditto ditto ; ditto ditto ; the place of the Moon dimly visible. |
| 30th Oct. midnight. | 74. | 78·0 | 77 0 | 1·0 | N N. W. | 0·10 | | 1 | 0 | | 0·0 | 0m. 10s. | 8 | Ditto ditto ditto ; ditto ditto ditto ditto. |

| H. M. | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 0 a. m | 722 | 78·2 | 76·0 | 2·2 | N. E. | Calm. | | 0 | 0 | | 0·0 | | 8 | Overcast with Nimbi and fleecy clouds. |
| 2 0 | 708 | 78·2 | 76·0 | 2 2 | ... | ... | | 0 | 0 | | 0·0 | | 8 | Nimbi scattered throughout the sky; a few drops of rain. |
| 3 0 | 697 | 78·0 | 76·0 | 2·0 | .. | ... | | 0 | 0 | | 0·0 | | 5 | Nimbi all round the hor.; otherwise clear. |
| 4 0 | 704 | 77·4 | 75·0 | 2·4 | NE. by N. | .. | | 0 | 0 | | 0·0 | | 4 | Dense Cirri, haze and Nimbi all round the hor.; the Zenith clear. |
| 5 0 | 726 | 77·6 | 76·0 | 1·6 | ... | ... | | 10 | 0 | | 0·0 | | 7 | Loose Nimbi all round the hor: and also cirrostrati. |
| 6 0 | 744 | 77 9 | 76·5 | 1·4 | .. | .. | | 01 | 0 | | 0·0 | 0m. 30s. | 7 | Ditto ditto ditto ditto ditto. |
| 7 0 | 768 | 78·6 | 76·5 | 2·0 | N. N. E. | 0·10 | | 0 | 0 | | 0·0 | | 6 | Cirrocumuli and Cirri scattered throughout the sky; mist along the W. hor. |
| 8 0 | 776 | 80·8 | 79·4 | 4·0 | ... | 0·10 | | 3 | 0 | | 0·0 | | 6 | Ditto ditto ditto ditto ditto ditto ditto. |
| 9 0 | 784 | 84·3 | 79·0 | 4·0 | ... | 0·10 | | 4 | 0 | | 0·0 | | 7 | Cumuli along the E. hor. from N. to S.; Cirrostrati and loose Nimbi scattered throughout; and mist in the W. hor. |
| 10 0 | 776 | 84·0 | 78·6 | 5·0 | .. | 0·10 | | 2 | 0 | | 0·0 | | 7 | Ditto ditto ditto; ditto ditto ditto ditto ditto. |
| 11 0 | 756 | 84·9 | 79·4 | 6·3 | ... | 0·10 | | 2 | 0 | | 0·0 | | 7 | Ditto ditto ditto; ditto ditto ditto ditto ditto. |
| Noon. | 729 | 86·6 | 80·0 | 7·2 | ... | 0·10 | | 1 | 0 | | 0·0 | | 7 | Ditto ditto ditto; ditto ditto ditto ditto ditto. |
| 1 0 p. m. | 680 | 87·8 | 79·0 | 7·8 | NE by E. | 0 10 | | 0 | 0 | | 0·0 | | 5 | Electrical clouds in the hor from N. E. to S.; and cirri scattered throughout. |
| 2 0 | 754 | 88·8 | 79·0 | 9·8 | .. | 0·10 | | 0 | 0 | | 0·0 | | 4 | Ditto ditto ditto ditto ditto ditto. |
| 3 0 | 645 | 90·2 | 81·0 | 9·2 | NE. by N. | 0·10 | | 0 | 0 | | 0·0 | Spark | 7 | The Electrical clouds becoming more dense; and fleecy clouds scattered throughout. |
| 4 0 | 642 | 91·0 | 81·0 | 10·0 | NW by W. | 0·1 | | | | | inches | 5 | 8 | Electrical Clouds in the E. horizon; Cumuli in the N. W. and N.; and Cirri scattered in the Zenith; thunder in the S. E. |
| 5 0 | 667 | 86·9 | 81·2 | 5·7 | N. W. | 0·3 | | out of scale. | 100 | 4 | 0·05 | 0·01 | 8 | Piles of Electrical Clouds all round the horizon except in the S. W.; loose Nimbi scattered in the Zenith; peals of thunder and vivid lightning in the E. S. E. |
| 6 0 | 688 | 83·8 | 79·0 | 4·8 | S. E. | 0·2 | | out. | out. | 7 | 0·07 | | 8 | Ditto ditto ditto ditto ditto ditto; loud peals of thunder in the E, and vivid lightning in the S. E.; raining lightly. |
| 7 0 | 728 | 77·7 | 75·0 | 2·7 | N. N. E. | 0·1 | 0·22 | ... | ... | 10to12 | 0·10 | 3 in 2 | 8 | Overcast with Electrical Clouds; vivid lightning and crashing peals of thunder in the N. N. W., and the Zenith at intervals of 5s.; raining heavily. |
| 8 0 | 750 | 77·4 | 76·2 | 1·2 | N. by E. | Calm. | 0·03 | ... | .. | 5 | 0·06 | 1 in 2 | 8 | Overcast with Nimbi; sheet lightning in the N. W., and W., distant thunder in the W. at intervals of 5m.; raining. |
| 9 0 | 745 | 77·4 | 76·5 | 0·9 | N | ... | 0·08 | .. | ... | 0 | spark. | 1·30 | 8 | Overcast with Nimbi; sheet lightning in the N. W. at long intervals; raining by night. |
| 10 0 | 741 | 77·3 | 76·4 | 0·9 | .. | .. | 0·02 | 12 | 0 | 0 | spark. | | 8 | Ditto ditto ditto; ditto ditto; no rain. |
| 11 0 | 740 | 77·0 | 76·0 | 1·0 | ... | 0·2 | | 10 | 0 | 0 | | | 8 | Ditto ditto ditto; ditto ditto; ditto. |

## *Observation from* 5.0 P. M. *on the 29th October to Noon on the 2nd November* 1854.

| Bombay Civil Time. | Standard Barometer, corrected to 32° Fhr | Therometers. Thermometer in the air. | Therometers. Wet-bulb Thermometer. | Depression of Wet-bulb Thermometer. | Wind. Direction. | Wind. Force in lbs. per square foot of surface | Rain in Inches. | Electrometer. Straw Electroscope. Volta No. 1. | Electrometer. Straw Electroscope. Volta No. 2. | Electrometer. Straw Electroscope. Henly's. | Electrometer. Ronald's Spark measure. Length of Spark. | Electrometer. Ronald's Spark measure. Corresponding frequency. | Extent of cloudy sky the whole sky,—8. | State of the Weather. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1st Oct. midnight. | 29·724 | 76·2 | 75·0 | 1·2 | E N. E. | 0·2 | | | | | | | 8 | Overcast with Nimbi; faint flashes of lightning in the N. W. |
| H. M. 1 0 a. m. | 699 | 76·0 | 75·0 | 1·0 | N E. | 0·1 | | | | | | | 8 | Overcast with Nimbi in two Strata. |
| 2 0 | 687 | 76·0 | 75·0 | 1·0 | E. | 0·1 | | | | | | | 7 | Nimbi scattered throughout the sky; stars in the Zenith dimly visible. |
| 3 0 | 676 | 77·0 | 75·0 | 2 0 | E N. E. | 0·1 | | | | | | | 6 | Ditto ditto ditto ditto ditto ditto ditto |
| 4 0 | 675 | 77·0 | 76·0 | 1·0 | N E. | 0·1 | | | | | | | 5 | Ditto ditto ditto ditto ditto ditto ditto. |
| 5 0 | 687 | 77·3 | 76·5 | 0·8 | N E by E. | 0·2 | | | | | | | 5 | Ditto ditto ditto ditto ditto ditto ditto. |
| 6 0 | 718 | 77·8 | 77·0 | 0·8 | E by N. | 0·1 | | | | | | | 7 | Loose Nimbi scattered throughout; cirrostrata in the horizon, and dense mist in the E. and W. horizon. |
| 7 0 | 745 | 78·3 | 77·5 | 0·8 | S E. | 0·1 | | 01 | | | | | 8 | Ditto ditto ditto ditto ditto ditto ditto ditto. |
| 8 0 | 756 | 79·8 | 77·5 | 2·3 | E S. E. | 0·1 | | 02 | | | | | 8 | Cumuli piled along the E. horizon; Cirrostrata all round the horizon; dense fleecy clouds scattered moving S. W.; and mist in the E. and W. horizon. |
| 9 0 | 779 | 80·5 | 78·3 | 2·2 | E N. E. | 0·1 | | 08 | | | | | 8 | Ditto ditto ditto; ditto ditto ditto ditto ditto |
| 10 0 | 776 | 82·2 | 79·4 | 2·8 | •• | 0·1 | | 03 | | | | | 8 | Cumuli in the horizon from N. E. to S. E.; and dense fleecy clouds scattered throughout. |
| 11 0 | 757 | 83·7 | 79·5 | 4·2 | E. | Calm. | | 01 | | | | | 8 | Ditto ditto ditto; ditto ditto ditto ditto. |
| Noon. | 740 | 84·2 | 79·4 | 4·8 | E by S. | •• | | 01 | | | | | 5 | Overcast with Nimbi; raining lightly. |
| 1 0 p.m. | 713 | 85·2 | 80 0 | 5·2 | ... | ... | | 01 | | | | | 8 | Ditto ditto; no rain. |
| 2 0 | 695 | 85·2 | 79·0 | 6·2 | E S. E. | ... | | 0 | | | | | 8 | Ditto ditto; a few drops of rain falling. |
| 3 0 | 691 | 79·0 | 84·0 | 6·0 | E by S, | •• | | 0 | | | | | 8 | Overcast with Nimbi in two strata, the lower stratum moving N. W. |
| 4 0 | 669 | 83·0 | 78·0 | 5·0 | S W. | 0·0 | | 0 | 0 | 0 | 0 | Sparks 5 | 8 | Overcast with Nimbi; low murmurings of thunder in the S. E. and E. horizon. |
| 5 0 | [illegible] | 81·7 | 77·4 | 4·3 | S. | 0·4 | | out of scale. | out of scale. | 5 | 0·05 | 1 in 2 | 8 | Overcast; Electrial clouds in the N., thunder in the S. E., and sheet lightning in the N.; raining lightly. |
| 6 0 | [illegible] | 80·3 | 77·5 | 2·8 | S by E. | 0·2 | 0·03 | 0·2 | •• | | | | 8 | Overcast; sheet lightning in the N., N. E. and S. E. horizon. |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 7 0 | 7[illegible] | 80 5 | 77·5 | 3·0 | S E. | 0·1 | | 0 | 0 | 9 | Overcast with Nimbi in two strata; sheet lightning in the N. E. |
| 8 0 | 7[illegible] | 80·0 | 77·0 | 3 0 | E. | 0·1 | | 0 | 0 | 8 | Ditto ditto ditto ditto S. E ; drops of rain. |
| 9 0 | 785 | 79·3 | 78·0 | 1·3 | N E. | 0·2 | 0·01 | 0 | 0 | 7 | Nimbi and fleecy clouds, the latter moving S. W.; stars in the Zenith dimly visible ; no rain. |
| 10 0 | 792 | 78·0 | 77·0 | 1·0 | E N. E. | 0·3 | | 0 | 0 | 8 | Overcast with Nimbi, in two strata ; raining lightly. |
| 11 0 | 779 | 77·5 | 75·2 | 2·3 | N N. E. | 0·2 | | 0 | 0 | 8 | Ditto ditto ditto ditto ditto ditto. |
| 1st Nov. midnight. | 767 | 77·3 | 76·0 | 1·3 | E N. E. | 0·3 | | 0 | 0 | 8 | Ditto ditto ditto ditto ; light rain at 0h 15m. |
| 1 0 a. m. | 742 | 76 8 | 76·0 | 1·8 | NE by E. | 0·1 | | 0 | 0 | 8 | Ditto ditto ditto ditto ditto ditto at 1·24. |
| 2 0 | 712 | 76·7 | 75·0 | 1·7 | E N E. | 0·1 | | 0 | 0 | 6 | Loose Nimbi scattered throughout the sky ; stars in the Zenith visible. |
| 3 0 | 710 | 77·0 | 75·0 | 2·0 | ... | 0·1 | | 0 | 0 | 8 | Nimbi scattered, in denser masses throughout the sky. |
| 4 0 | 714 | 77·4 | 76·0 | 1·4 | N E. | 0·1 | | 0 | 0 | 8 | Overcast with Nimbi. |
| 5 0 | 721 | 77·9 | 76·5 | 1·3 | E by N. | 0·2 | | 0 | 0 | 7 | Nearly overcast with Nimbi; light drops of rain falling. |
| 6 0 | 743 | 77·0 | 75·2 | 0·7 | .. | 0·1 | 0·02 | 0 | 0 | 8 | Overcast with Nimbi; light drizzling rain. |
| 7 0 | 785 | 77 2 | 75·4 | 0·8 | S E. | 0·6 | 0·04 | 2 | 0 | 8 | Ditto ditto ditto ; raining lightly. |
| 8 0 | 793 | 76 0 | 76·4 | 1·6 | E. S. E. | 0·5 | 0·16 | 0 | 0 | 8 | Ditto ditto ditto; ditto ditto. |
| 9 0 | 811 | 77·0 | 76·4 | 2·6 | N E by E. | 0·3 | 0·03 | 0 | 0 | 8 | Ditto ditto ditto; ditto ditto. |
| 10 0 | 797 | 79·0 | 76·0 | 3·6 | E N. E. | 0 9 | | 0 | 0 | 8 | Ditto ditto ditto; ditto ditto. |
| 11 0 | 771 | 80 0 | 76·0 | 3·6 | E by S. | 0·6 | | 0 | 0 | 8 | Ditto ditto ditto. |
| Noon. | 737 | 80·0 | 75·0 | 4·8 | ... | 0 8 | | 0 | 0 | 8 | Ditto ditto ditto. |
| 1 0 p.m. | 689 | 80·8 | 75·0 | 2·0 | ... | 1·0 | | 0 | 0 | 8 | Ditto ditto ditto ; raining lightly. |
| 2 0 | 671 | 78·0 | 76·0 | 2·4 | .. | 1·0 | 0·02 | 0 | 0 | 8 | Ditto ditto ditto; ditto ditto. |
| 3 0 | 617 | 77·4 | 75·0 | 2·2 | ... | 2·1 | 0·01 | 0 | 0 | 8 | Overcast with Nimbi in two strata, the lower stratum moving N. W.; strong gusts of wind. |
| 4 0 | 622 | 77·2 | 75·0 | 2·2 | E S. E. | 1·25 | | | | 8 | Overcast with Nimbi in two strata, the lower stratum moving N. W.; strong gusts of wind. |
| 5 0 | 659 | 78·5 | 76·0 | 2·5 | .. | 2·50 | | | | 8 | Ditto ditto ditto ditto ditto. |
| 6 0 | 661 | 77·6 | 75·0 | 2·6 | .. | 1·50 | | | | 8 | Ditto ditto ditto ditto ditto. |
| 7 0 | 662 | 78·4 | 76·0 | 2·4 | .. | 2·10 | | | | 8 | Ditto ditto ditto ditto ditto; the wind has increased to a gale. |
| 8 0 | 666 | 77·6 | 76·0 | 1·6 | .. | 2·80 | 0 01 | | | 8 | Overcast with Nimbi; the wind blowing a steady gale : light rain at 8h. 52m. |
| 9 0 | 638 | 77·4 | 76·0 | 1·4 | .. | 3·00 | 0·02 | | | 6 | Ditto ditto ditto ditto ; ditto ditto ditto ; raining lightly. |
| 10 0 | 607 | 76·5 | 76·0 | 0·5 | .. | 5·00 | 0·12 | | | 8 | Densely overcast ; raining ; the gale increasing and at times blowing in violent puffs. |
| 11 0 | 574 | 76·5 | 76·0 | 0·5 | ... | 4·25 | 0·13 | | | 8 | Ditto ditto; ditto ditto ditto ditto ditto. |
| 2d Nov. midnight. | 521 | 76·4 | 76·4 | 0·0 | S E by E. | 10·00 | 0·10 | 0·10 | | 8 | Ditto ditto; ditto ditto ditto ditto ditto. |
| 1 0 a. m. | 460 | 76·7 | 76·0 | 0·7 | S E. | 15·00 | 0·06 | 0·06 | | 8 | Densely Overcast; raining; vivid lightning in the Zenith : the wind has increased to a storm. |

*Observations from 5.0 P. M. on the 29th October to Noon on the 2nd November 1854.*

| Bombay Civil Time | Standard Barometer corrected to 32° Fhr. | Thermometers. Thermometer in the air. | Thermometers. Wet-bulb Thermometer. | Depression of Wet-bulb Thermometer. | Wind. Direction. | Wind. Force in lbs. per square foot of surface | Rain in Inches. | Electrometer. Straw Electroscope. Valta No. 1. | Electrometer. Straw Electroscope. Valta No. 1. | Electrometer. Straw Electroscope. Henly's. | Electrometer. Ronald's spark measure. Length of Spark. | Electrometer. Ronald's spark measure. Corresponding frequency. | Extent of cloudy sky the whole sky—8. | State of the Weather. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2d Nov. H. M. | | | | | | | | | | | | | | |
| 2 0 a. m. | 29·394 | 76·0 | 76·0 | 0·0 | S E. | 21·00 | 0·03 | | | | | | 8 | Densely overcast; raining lightly; the wind has increased to a great storm: tile from the Observatory roof flying abou, and the lighter branches of trees snapping asunder: the night intensely dark. |
| 3 0 | 268 | 76·0 | 76·0 | 0·0 | S E by S | 35·0 | 0·05 | | | | | | 6 | Densely overcast; raining lightly; the wind has risen to a great Hurricane: the trees are rent asunder and failling across the walks in the compound; doors are blown in; terrible darkness. |
| 4 0 | 183 | 77·2 | 77·2 | 0·0 | S by S. | 35·0 | 0·03 | | | | | | 8 | No perceptible change for the better: awful roaring of the wind and crackling of trees falling. |
| 5 0 | 208 | 77·4 | 76·8 | 0·6 | W by S. | 29 0 | 0·02 | | | | | | 8 | The work of destruction still going on without any change since the last hour. |
| 6 0 | 465 | 77·0 | 76·4 | 0 6 | W N. W. | 24·0 | 0·02 | | | | | | 8 | The Hurricane is moderating considerably; but the aspect of the sky is very gloomy. |
| 7 0 | 602 | 77·2 | 75·3 | 1·9 | .. | 3·0 | 0·02 | | | | | | 6 | The Hurricane has entirely subsided, still there is a fresh gale blowing accompanied with spurts of rain. |
| 8 0 | 684 | 77·0 | 76·0 | 1·0 | W by N. | 3 0 | | | | | | | 8 | Overcast with loose Nimbi : the clouds rising higher in the atmosphere: lightning in the N.; and heavy rain. |
| 9 0 | 736 | 76·8 | 76·0 | 0·8 | W. | 1·0 | 0·37 | | | | | | 8 | Overcast with Nimbi moving E.; raining heavily. |
| 10 0 | 758 | 77·3 | 77·0 | 0·3 | N W by W. | 0·3 | | | | | | | 8 | Ditto ditto ditto ditto; no rain. |
| 11 0 | 762 | 80·0 | 77·5 | 2·5 | .. | 0·2 | | | | | | | 6 | Overcast with loose Nimbi moving N. E. |

The following short abstract affords a comparison betwixt the Observatory Barometeric readings and my own—nine miles to the N. E. by N.

The former only gives the hours, the latter are mostly made at broken times.

| A. M. | Sewree. | Colaba | Difference. | |
|---|---|---|---|---|
| 1 | 29·525 | 29·460 | + | 065 |
| 3 | ·370 | ·268 | + | 102 |
| 3-40 | ·308 | .... | | .... |
| 4 | ·247 | ·183 | + | 064 |
| 4-40 | ·158 | .... | | ...... |
| 6 | ·177 | ·465 | — | 288 |
| 6-30 | ·387 | .... | | .... |
| 8-30 | ·731 | .... | | .... |
| 10 | ·775 | ·758 | + | 017 |
| 10-30 | ·785 | .... | | .... |

As the crisis of the storm occurred nearly an hour later at Sewree than at Colabah, the 4 and 6 o'clock observations of the latter should be compared with the 4.40 and 6.30 of the former,—and the difference will be found to be no more than ·025 and ·058. The Sewree observations were made at irregular intervals, as the tempest dashing the glass from the windows adjoining the barometer, blowing to pieces the roof, tearing down the ceiling, and blowing out the light permitted, those of the Observatory every hour: those of the latter are only given here which may be compared with the former, they will be found complete in the tables above.

The following is from the Log of the Iron Steamer *Pottinger*, anchored off Mazagon, 3 miles S. of Sewree, and 6 N. E. of the Observatory.

| November 1st. | Uncorrected. | Corrected approximately. |
|---|---|---|
| Noon | [illegible] | 29·575 |
| 8 P. M. | ·700 | ·575 |
| 10-30 P. M. | ·600 | ·475 |
| Midnight | ·500 | ·375 |
| 3-15 | ·450 | ·325 |
| 3-30 | ·400 | ·275 |
| 4 | ·360 | ·235 |
| 4-30 | ·270 | ·148 |
| 5 | ·240 | ·115 |
| 5-30 | ·270 | ·155 |
| 6 | ·300 | ·275 |
| 6-30 | ·400 | ·375 |
| 7 | ·570 | ·445 |

Gradually rising.

It will be seen that at 4-40 the mercury at Sewree had reached the depression of 29·158, a thing I believe unprecedented in Bombay, and that in three hours it had run down about three and half tenths of an inch. Its re-ascent was quite as rapid as its descent, having at ten o'clock attained an altitude of [illegible] having thus in six hours risen six tenths and a quarter, or considerably upwards of its average range in the whole year.

In comparing the two sets of observations with each other, it will be perceived that at the commencement, the conclusion, and the middle of the gale, the corresponding readings differ less than the two standard Barometers of the Observatory hung side by side often do from each other. The matter is one of the greatest importance, as it enables us even by observations made in the Island of Bombay to track the centre of the storm which was thus shown to have travelled northerly, at the rate probably of fifteen miles an hour. Had the Observatory's instruments been read every ten minutes, as they were in cases of crisis in 1844, if we may judge from the rate of the descent of the mercury, the centre of the hurricane passed at 4-10, and not at 4 o'clock, as is assumed. The *Pottinger's* Barometer reached its minimum at 5, and had begun to rise at 5-30—mine may probably have descended to this hour or even beyond it, I have no readings from 4-40 till 6. At Colaba, the most violent portion of the gale was experienced from the South East, and it was nearly lull at the change. At Sewree the wind merely slackened a little, and it was by far the most violent from South West, and that fully an hour after it is reported to have blown by at the Observatory; the difference betwixt the Barometers accordingly is much the greatest at six A. M., where the mercury at Sewree was ·288 lower than at Colaha, nearly the same, indeed, as the Observatory's minimum. I do not believe that the centre of the hurricane passed either over Colaba or Sewree, but am convinced that it was to the westward of both; at both places the wind blew for at least half an hour from south—right under the centre this could not have occurred. The south-east gale would have been followed at once by one from south-west, a dead lull intervening—a northerly wind again would indicate the centre to have been to the eastward. The Colaba returns are of very great value, and show most clearly that betwixt Saturday and Wednesday we had two perfectly distinct classes of storms to deal with—the first our ordinary November squalls, the second a well defined revolving hurricane. All traces of the first had vanished on Wednesday morning, and accordingly at 9 o'clock the Barometer stood at 29·811 higher than it had been at any time since the 28th, and this fortunately afforded the means of warning us of what was approaching, and only ·085 lower than its average. The plunge down of ·130 which took place betwixt this and 2 o'clock, combined with the state of the atmosphere and direction of the wind, added to the fact that the thunder storms were now over, indicated as clearly as dawn does sunrise, that mischief was at hand, and that too quite in time to give warning to those who might have benefitted by it. The mean altitude of the Barometer for October and November together—and that due to the 1st of the latter month must be assumed as the mean of the two — is 29·362; the mean morning maximum 29·896, so that the mercury which stood at 29·811 on the 1st was just recovering from its thunder storm depression: it fell ·179 for the afternoon tide at 4 o'clock, and only rose ·007 at 9 P. M., virtually falling ·120 in 11 hours. It must be remembered that out of the eight hurricanes which have visited the Arabian Sea since 1783, four have occurred in the first week of November,—that they cross Bombay at an average of 17 or 18 years, and that the last which passed over us, was that of 1837, exactly seventeen years ago.

In the harbour the damage done was very great; the Castle Signal Flag Staff broke across about ten feet above the base, a pretty clear indication of the force of the gale. The H. C. Steamer *Assaye* drifted towards the

Castle walls and snapped her bowsprit, but fortunately was successful in getting off again into deep water. The H. C. Receiving Ship *Hastings* drove from her moorings and sprung a leak; at daylight she exhibited signals of distress when the H. C. Steamer *Queen* was ordered to proceed to take her in tow, but in endeavoring to do so, she got foul of the ship *Mystery*, and remained in that position for several hours, the *Hastings* having been otherwise relieved, and brought to a mooring in Mazagon,—where she sunk in the mud, and was afterwards broken up. The survey Brig *Palinurus* got aground some forty or fifty yards off the Dockyard breakwater, her mainmasts were swept away, with all the rigging left hanging over the sides; her situation at one time was most perilous, as she was thumping on the rocks, but she floated with the tide, and was warped in by the aid of Pilots sent to her, into the Custom House basin. Most of the Merchantmen exhibited signals of distress and made calls for Pilots, the Master Attendant and his assistants doing all in their power to afford them aid. The Governor's and Sir Henry Leeke's Barges and nearly all the pleasure Yatchs, Bunder Boats, and country craft usually moored off the Apollo pier were lost. After day break their spars, planks, cabin partitions &c., were found strewed about the shore between the Dockyard and the Coal Depot at Colaba. The H. C. Sloop of War *Elphinstone* got aground right in front of the Custom House basin, hauled up her cables and backed astern with the breeze; then set stay-sail and bore away to the North and West, anchoring outside of the shipping. About Boree Bunder and along the line of shore, hundreds of native craft grounded, the state of a great many of the sterns and sides furnishing plain proof of violent collisions. Nearly every vessel in harbour dragged from her original position and sustained some damage or other. The ship *Eliza* drove back before the tremendous wind and struck the *James Turcan*, which was dismasted, breaking her bowsprit and foremast just above the deck, and destroying all the main and mizen rigging, the *Eliza* having her quarter seriously injured, and the tiller and tiller-chain broken. The Imaam of Muscat's ship was dismasted. The Steamers *George Russell Clerk* and *Sir Jamsetjee Jeejeebhoy* became total wrecks off the Castle, the *Phlox* also drifted on the rocks in the same locality. Her Commander, Captain Ellis, with his wife and a friend, were with difficulty rescued from watery graves. About twenty of the crews of the wrecked steamers were saved at the Castle wharf by the exertions of a non-commissioned officer and a party of Lascars.

On shore many of the houses and large buildings in the Fort, especially those in Rampart Row, were severely damaged. All the temporary Bungalows on the Esplanade were swept away, and most of the largest trees on both sides of the road torn-up by the roots. The losses in the Native Town were immense, the roads all over the island were strewed with the branches of trees; in many parts, for several hours, their passage was obstructed by huge cocoanut trees; two of which in falling caused fatal accidents, killing three and wounded seven others. At Mahim the loss of property and gardens was very great, the tempest prevailed there with much violence, and two Mahomedans were killed by the falling of trees. The storm was equally severe at Bandora, where the English Church was stripped of its roof, and several houses levelled with the ground. At Callian too it was quite as rough as here, houses being blown down, trees torn up by the root. It extended to the mainland, I presume to the east of us, but was much lighter than at Bombay: it seems to have done no harm in this direction further eastward.

*Vessels wrecked and damaged.*

| No. of Vessels. | Description of Vessels | Total Wrecks. | Damaged. | Supposed estimate of Property lost. Rupees. | No. of Lives lost. | No. of Bodies found by the Police. | Remarks. |
|---|---|---|---|---|---|---|---|
| 18 | Square rigged... | 5 | 8 | unknown. | ... | | Total Wrecks.—*Forfarshire, Sufina Tulla, Jaffer, G. R. Clerk, Sir Jamsetjee Jejeebhoy and Phlox.* |
| 12 | H. C. large and small... ... ... | 7 | 5 | unknown. | 4 natives. | | |
| 7 | Yachts............ | 7 | ... | 23,000 | | | |
| 42 | Buglows...... ... | 18 | 24 | 2,166,330 | 91 | 42 of different caste. | Many of these Vessels have drifted to sea and probably on the opposite coast of which no account has been gained. |
| 2 | Gunjah... ... ... | 1 | 1 | 46,500 | 4 | | |
| 2 | Dhows............ | 1 | 1 | 12,740 | 16 | | |
| 15 | Patimars...... ... | 9 | 6 | 33,710 | unknown. | | |
| 45 | Coteahs... ... ... | 40 | 5 | 80,920 | unknown. | | |
| 17 | Dingeys... ... ... | 17 | ... | 32,500 | unknown. | | |
| 9 | Gulbuts... ... ... | 9 | ... | 2,200 | ... | | |
| 26 | Batillas ...... ... | 20 | 6 | 27,835 | ... | | |
| 11 | Padows... ... ... | 11 | ... | 22,200 | | | |
| 201 | | 154 | 56 | 2,479,935 | 115 | 42 | |

W. H. G. DUNLOP,
Superintendent of Water Police.

The damage sustained by the thirteen square rigged vessels, and the twelve vessels of the Honorable Company large and small, it will be observed, is still unknown; but if the loss sustained by the Native Craft alone amounts to 24,79.935 rupees (£247,993); we may, at a reasonable calculation, put down that of the large ships and steamers as twice as much; which, with the merchandise which was recovered but partially damaged, will amount to nearly the amount we first set it down at, viz., a crore of rupees (one million sterling). One hundred and forty-five vessels are total wrecks, and fifty-six more or less damaged. The number of lives known to be lost is one hundred and fourteen; but judging from the number of vessels total wrecks, and the proportion of bodies picked up by the Police, we should say nearly a thousand human beings must have perished. We do not think the whole history of storms could furnish a parallel to the Cyclone of the 2nd November,—its terrible effects being felt both by sea and land.

Half the native craft might have been saved had warning been given before sunset, when the signs of the hurricane were unmistakeable. £120,000 with 50 lives at least were sacrificed on the shrine of slighted science.

Hurricanes seem to visit Bombay periodically, but at very distant intervals, the earliest on record is that of May 25th 1647—when we had a furious thunder-storm and earthquake. In April 1782, a violent hurricane swept the Gulf of Cambay, accompanied by a dreadful inundation—probably the storm wave: our notices of this are so scanty, that it is impossible to say whether it was a cyclone or merely a local gale; the next two occurred on the 5th of November 1783 and 1799 respectively, when on both occasions many ships were lost, and in the latter of these above two hundred Native vessels foundered or were

wrecked. In September 1819, a violent gale devastated Cutch, but seems to have been but slightly felt at Bombay. In November 1827, a hurricane swept to the westward of Bombay, and stretched northward towards Katteewar, the loss of lives is said to have been fearful, forty bodies were washed ashore near the light house the first tide after its occurrence. The hurricane of June 1837 is said to have occasioned a loss to the shipping of above seven lakhs of Rupees (£70,000) four hundred houses in the native town were blown down, and several substantial buildings materially injured. The terrible hurricane of April 1847, in which the *Cleopatra* Steamer was lost, but slightly manifested itself at Bombay, and passed to the Northward some hundred miles to the West of us. We have not observed that the violent storm of the 23rd of June 1853, possessed any of the characteristics of a hurricane, or was more than a furious outburst of the monsoon, and the Arabian Sea does not seem to be visited oftener than once in ten or fifteen years on an average by a well defined cyclone.

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Analysis of Ships' Logs.—The following, so far as I can discover, comprise amongst them extracts from the logs of nearly every vessel exposed to the influence of the hurricane. The smallness of their number is accounted for by the limited range of the blast. I have given their positions, and the date and direction of the wind when the gale struck and left them: the logs themselves are full of interest, obviously the productions of good seamen and intelligent men. A Native clerk, in copying some of the extracts, has to all appearance blundered sadly in the readings of the instruments, which are frequently described as falling when they are represented as rising: these I have left as I found them—there are several instances of transposition, where the barometer is set down at 27 inches, when the previous reading had been 29; and the sympiesometer, represented as sinking, is made to jump from the former to the latter of these figures; these I have ventured on correcting. I have also endeavoured to disentangle as far as possible the phenomena of the thunderstorm from those of the hurricane, apt to be confounded from their running almost into each other before the shifting of the wind disclosed the cyclone; where the former were occurring simultaneously all along, the latter travelling at the rate of 15 miles an hour, or 360 a day: if, as seems most probable, the whole space traversed by the centre of the cyclone did not exceed 200, that by the circumference 300 miles.

### *Extract from the Log of the Ship Tara, from Aden to Bombay.*

The accompanying report on the weather, as experienced on board the ship *Tara*, Captain Charles E. Grant, on her passage from Aden to Bombay, during the late hurricane, will, we trust, prove interesting:—" On the 30th October 1854, at noon, in Latitude 13 ° 37., and Longitude 70 ° 30. E., with light and variable winds from North East to South West; weather very unsettled, the sky having a very wild appearance, and coming off at night in severe squalls from the north East.—At 11 P. M., the sky assumed a very wild appearance from West and South West, banks of dark clouds, the upper part of sickly yellow appearance; when from the North East arose a heavy bank of dark clouds, resembling a high wall; shortened sail to the double-reefed top sails. Midnight, blowing a strong gale North West standing N. N. East, At noon from 31st, blowing a strong gale from West, with heavy rain and hard squalls, sent down royal yard, prepared for the coming gale. At noon, Barometer 29.2, Sympisometer 27·30., and unsteady at that; the sky having a very wild appearance to the North West, with a heavy sea from the north. At 3 P. M. Barometer falling rapidly to 29·40., Sympisometer 29.20., furled the close reefed top sails and fore course, and wore ship to the south east, the wind then blowing in severe squalls from South West. At 8 P. M. the Barometer and Sympisometer rising (and the weather breaking,) the former 29·45', latter 27.60, wore ship and ran to the N. N. East under a reefed fore-sail, supposing that the Cylone was travelling to the

N. West of the ship. Midnight, strong gales with a heavy sea, and severe squalls and rain, with vivid lightning to the North West; the lightning being such as all on board had never before seen flashing in broad sheets.—During the night, the wind held pretty steady at S. S. W., except in the squalls, when it came to Eastward of South.—At noon November 1st, 1854, Longitude 72° 31. East, sounded in 20 fathoms and wore ship to the North West, the weather having a very wild appearance, the Barometer at noon 29.50., Sympisometer 27·60., and oscillating much. At 4 P M having ran off about 30 miles, hove ship to with head to the Eastward. At 5 P M find the wind veering to the Eastward of South, wore and brought to on the port tack head to the South West, under a close reefed mainsail, and top sail. At 8 P M blowing a heavy gale, the wind veering all the time to the Eastward, and Barometer falling rapidly, Barometer 27.15, Sympisometer 29.30.. At 9.30. P M violent gusts of wind from the North East, furled the maintop sails; Barometer 29.10., Sympisometer 27.90., gale blowing violent from the North East till 11 P M when it lulled. The Barometer and Sympisometer still falling, afraid the ship close to the centre of the Cylone. Midnight, Barometer 27.0., Sympisometer 26.90. Half an hour after midnight, the Cyclone burst on the ship from North West with fearful violence, and continued without intermission till 3.30 A M before any further lull; the Barometer at 2 A M 29.0., Sympisometer 28.75.; at 3 A M Barometer 29.05., Sympisometer 28 29.; at 4 A M Barometer 29.15, Sympisometer 29.10., still blowing a strong gale. At 6 A M Barometer 29.30, Symisometer 29.30, moderating fast and the weather clearing up.—At [illegible] the closed reefed topsails and fore sail. Noon, November 2nd, Latitude 19°. Longitude 72° 34° East. Bore up, made all sail for Bombay Harbour, at 5 P M passed the outer light ship, and at 6 P M came to anchor in the harbour, having weathered the Cyclone without the least injury to ship, spars, or sails."

Ship Futta Moombaruck, J. Wadge, from China 21st August; touched at Anger September 23rd—experienced a Cyclone in lat. 6 South, long. 35 ° 30 East, on the 6th October, also a very severe S. W. gale on the 1st November in lat. 16 ° 40 North, long 30° East; spoke the El Dorada 14° North 71° East. Ship Triumph, R T Jackson, for Bombay from Calcutta 30th September; experienced very severe weather on the 1st and 2nd November with high confused sea, lost foremain-top-gallant-mast and sails, lat. between 16 ° 30. N and 17° N., wind veering from lat. S. W. 20 miles off the Coast.

## *Remarks on a Cyclone experienced by the Ship Arracan, on her passage from Liverpool to Bombay, 1st November 1854, lat. 17 ° 24' N, long. 71 ° 26' East.*

October 30th and 31st,—Squally unsettled weather with torrents of rain, wind veering from N. E. to E. N. E. with threatening appearance and falling Baremeter.

November 1st.—4 A M Wind about N E, tacked ship to the E S E, dark lowering threatening appearance with heavy rain, Barometer 29.55 Sympr. 29.70, double reefed the topsails and stowed the jib and main sail.—6th A M Increasing gale—close reefed the topsails and furl'd the foresail.—8 A M Blowing hard, took in the fore and mizen topsails, and hove the ship to under close reefed main topsail, Barometer 29 40, Sympr. 29.65, sent down main royal yard and prepared for a gale. Noon—blowing excessive hard, Barometer 29.50. Sympr. 29.60, with torrents of rain. At 9 A M when the heaviest of the gale commenced, the wind then N N E consequently the centre of the cyclone, bearing E. S. E., the wind veering gradually round to the North and N. N. W. At noon the wind had veered round to N. N. W., bringing the centre of the cyclone to bear E. N. E., showing the cyclone to be travelling to the North Westward, across our bows, and at no very great distance. At 3 P M the Barometer had risen to 29.55, Sympr. 29.62 with decreasing gale. At 3.30 set close reefed foretopsail and bore up to N. E., the wind then about N. W., gale gradually taking off, made sale accordingly, made a small diagram of the bearings of the cyclone at different times, say 9 A. M. and noon, and considered it to be travelling about N. W. ½ N., about 15 miles an hour.

## *Extracts from the Log of the P. and O. Co.'s Steam Ship Cadiz, from Point de Galle to Bombay.*

Sunday, Oct. 29.—3.45 P. M. Unmoored ship and proceeded slow.—3 55. Stopped and discharged Pilot.—4. Proceeded full speed, hands employed stowing anchors.—6. Set all fore and aft sail.—Sunset. Set the watches on bridge and forecastle.—8. Galle Lighthouse East 12 miles, moderate breeze and cloudy, set all square sail, Bar. 29.97. Symp. 29.35.—9.10 Squally with heavy rain, in all square sail.—10.30. Out lights.—Midnight. Moderate breeze and cloudy, Bar. 29.95, Symp. 29.32.

Monday, 30th Oct.—1. A. M. Fresh breeze and squally, with rain.—2.50. Latitude by Rigil 7 ° 13 North.—4. Strong breeze and squally with rain, Bar. 29.90, Symp. 29.35.—5. Strong weather, in all fore and aft sail.—Daylight. More moderate and clearing up, set fore and aft sail.—8. Bar. 29.93, Symp. 26.25.—10. Crossed top gallant yards, hands employed as required—Noon. Fresh breeze and hazy weather, Bar. 29.95, Symp. 23.18.

00.15, A. M.—Observed the high land about Cape Comorin bearing N. N. W. about 16 miles.—3. Moderate breeze and cloudy, in all square sails.—4. Examined the hold ; saw the Crocodile Rock N. W. ½ W. 6 miles, Bar. 29.93, Symp. 29.35—4.50. Crocodile Rock North 1½ miles.—6. Squally with rain, in main trysail.—Sunset. Set the night watches on bridge and forecastle.—7. Bar. 29.95, Symp. 29.32.—8. Squally with heavy rain.—9. Squally with heavy rain, in outer jib.—10.30, Squally with heavy rain.—Midnight. Squally with heavy rain, Bar. 29.94, Symp 29 40.

Tuesday, 31st October.—1 A. M Strong breeze and squally, with constant rain.—3. Hard squalls with heavy rain, in all sail.—4. Squally with constant rain and thick cloudy weather, with a heavy S W swell up, Bar. 29.92, Symp. 29.43.—Daylight. Turned the hands out, employed variously.—8. Squally with rain, Bar 29.93, Symp. 29.45.—9.30. Set all fore and aft sail.—10. Set all square sail and fore top sail.—11.30. Squally with rain, in fore and topsail—Noon. Split foresail, up foresail and furled top gallant sails and outer jib, Bar. 29.93, Symp. 29.[illegible]

1 P. M.—Strong breeze and squally, with thick rain, hands employed variously as required.—2. Set outer jib.—3.30. Exchanged colours with a French Ship from Bordeaux bound to Cochin ; examined the holds.—4. Fresh breeze and squally with rain, Bar. 29.99, Symp. 29.42—Sunset. Set the look-out on bridge, and forecastle.—8.30. Latitude by Formalhant 10.40. N.—9·30. Set all plain sail.—10. 30. Squally with rain, out lights.—Midnight. Falling calm, in all sail Bar. 29.37. Symp. 29.37.

Wednesday, November 1st.—1. A M.—Fresh breeze and squally with constant rain, in all sails and stowed them.—2.40 Latitude by Rigil 11° 40' N.—4. Squally with heavy rain, Bar. 29.93, Symp. 29.35.—Daylight. Squally with rain, set fore and aft sail, employed cleaning ship fore and aft, examined the hold.—7. Wind drawing aft, set all square sail and fore topmast and lower studding sail.—8. Moderate breeze and cloudy, set main top mast studding sail, Bar. 30.00, Symp. 29.38.—10. Hands emloyed variously as required, carpenter on boats yards, his mate upon lockers under the forecastle.—Noon. Squally with heavy rain, Bar. 29.99, Symp. 20.40.

1. P M.—Passing squalls with heavy rain, in all studding sails, and more moderate, unbent, the foresail being split.—4. Moderate breeze and cloudy, Bar. 29.91, Symp. 29.45.—Sunset. Set the night watches on bridge and forecastle.—8 Light breeze and cloudy, Bar. 29.95, Symp. 29.35.—Sunset. Set the night watches on bridge and forecastle.—8. Light breeze and cloudy, Bar. 29.95, Symp. 29.35.—8.25. Latitude by Formalhant 14.00 N.—10.30 Steady breeze and cloudy, set topmast studding sails, latitude by Aretics. 14° 27 N.—Midnight. Moderate breeze and fine, windsail set, Bar 29.93, Symp 29.31.

Thursday, Nov. 2nd.—1 A. M Set main topmast studding sail.—2. Latitude by Aldabaram 14° 49 N.—2.40. Latitude by Capalla 14 ° 57' N. —3 50. Latitude by Canopus 15 5 N.—4. Moderate breeze and squally, Bar. 29.91, Symp. 29.32.—5.20. Latitude by Pole star 5 ° 18' N.—Daylight. Turned the hands out, cleaned ship fore and aft, trimmed sails and examined the hold.—8. Fresh breeze with passing squalls, hands employed repairing fore and other work. Carpenter making Boats yards, Bar. 29.92, Symp. 29.31.—12. Squally with rain, in studding sail, Bar. 29.92, Symp. 29.29.

## *Extract from Log of the Ship Futta Moombaruck, J. L. Wadge, Commander, from China to Bombay.*

Friday, 6th October.—1 P M. Strong winds with frequent head squalls, double reefed fore and mizen topsails, furled jib and mainsail, Bar. 29.70.—6. Fresh gales, a high sea on, ship labouring heavily.—8. Do. weather, frequent severe squalls, Bar. 29.68.—Midnight. Strong gales ; in foresail and mizen topsails, down mizen top gallant and royal yards, double-reefed the main topsail, a high sea on, ship lurching heavily.—2.30 A. M. Moderating.—4. Light breeze at E. S. E. and cloudy ; squally appearances at N. W.—5. Wind shifted to the S. W.—Day light. Light breeze and fine ; out all reefs and made all plain sail.—8. Moderate breeze and squally appearances at Westward.—9. Wind increasing in heavy squalls, single reefed the topsails, in mizen topsail and up mainsail, which blew away, down jib ; sea rising very rapidly and ship labouring

heavily.—10. Wind increasing to a gale with a high sea on, ship labouring heavily, and shipping much water over all, split the main topsail, while double reefing it clued it up and furled it, up foresail and furled it.—Noon. Blowing a hard gale from the N. W., a tremendous sea running, ship labouring heavily and shipping much water. Lat. by acct. 6° 5' S., Long, by acct. 66 ° 18' E., Long. chr. 65 38 E.

Saturday, October 7th.—1 10 P. M. Strong gales, a very high sea running, ship labouring heavily and shipping much water, took in the foretopsail, split foretopmast staysail—ship now under bare poles.—2. Barometer 29.65, Ther. 74.—4. Bar. 29.65, Ther. 72.—6. Bar. 29.65, Ther. 70.—8. Gale moderating, Bar 29.68, Ther. 70.—11. Wind veering to the S. E., wore round to the N. E.—Midnight. Set foresail foretopsail, and shifted mizen topsail, and set it single reefed to keep the ship to the wind; the driver boom having unshipped during the strength of the gale, Bar. 29.68.—4. A. M. Strong breeze and squally, Bar. 29.70.—Daylight. Fresh breeze with passing squalls and rain; set jib; shifted the fore and maintopsail, and set them, shipped the driver boom, and set the sail, set top-gallant sail.—Noon. Passing squalls and light rain, Lat. by Indiff. observation 6°25' South, Long. by chron 65·50 E., current in two days S. by W. ½ W. 47.' Bar. 29.60, Ther 76.—1. P. M. Moderate breeze and passing squalls.—4. Light breeze and cloudy.—Sunset. Squally with rain, single reefed the topsails.—8. Breeze very unsteady, with passing squalls and rain, Bar. 29.80—Midnight. Light breeze and fine :—Daylight. Light breeze and fine, out all reefs, and crossed royal yards; passed a Sch[illegible]ng to the Westward.—Noon. Light breeze and fine, Lat. by observation 5·25 N., Long. by chron, 65·[illegible] E., Bar. 29·82, Ther. 85, current E. 12, Variation ¾ pt. W.

Tuesday, October 31st.—1 P. M. Moderate breeze and cloudy.—1.30 Exchanged Nos, with the Barque Eldorado.—4. Passing squalls with rain.—6. Moderate breeze and cloudy, a head sea on—Eldorado East—a high sea on.—8. Light breeze and cloudy.—9.15. Tacked.—11 Squally appearances at Westward, tacked; sudden shift of wind at Westward, squally with constant rain.—Midnight. Moderate breeze, and thick cloudy appearance.—A. M. Wind increasing in squalls.—1. Up mainsail and in jib, and singled reefed the topsails.—4. Strong winds and dark cloudy weather with constant rain and hard squalls, Bar. 29.68.—Daylight. Wind increasing to a gale and sea rising fast; ship pitching very heavily, and shipping much water, furled mizen topsail, up foresail, close-reefed fore top sail, and double reefed main topsail.—8. Strong gale, a very heavy confused sea on, ship labouring and plunging heavily and shipping much water, down royal yards.—10. A sail to the Eastward standing at S. E.—10.30. Gale increasing with a tremendous cross sea on; ship plunging very heavily and shipping much water; in foretopsail.—Noon. Strong gale at Westward; in main top sail; ship plunging bows under; wore ship to the Southward, Lat. obs. 15°22 N. Long chr. 71 ° 31' E., Current S. E. 12, Bar. 29.67, Ther. 81.

Wednesday, November 1st.—P. M. Stong gales, a tremendous sea on, ship labouring and plunging heavily and shipping much water; pitched away the flying jibboom.—1. Close reefed the main top sail and hove to under it, Bar. 29.67.—2. Bar. 29.68.—4. Wore round to the North ward, Bar. 29.65, set foretopsail close reefed.—6. Hard gales with a tremendous sea on, Bar. 29.65.—8. Strong gales blowing in furious gusts, and vivid lightning at N. Wd; in main topsail, Bar. 29.65—10. In foretopsail, Bar. 29·5 8.—Midnight. Wind blowing with hurricane force with terrific squalls; split main and foretopsail, hove ship to under bare poles, on port tack Bar. 29.54.—4. Continuous hard gales and tremendous sea, ship labouring very heavily, Bar. 29.54.—Daylight. Continuous hard gales; weather clearing up from S. W. to S E., Bar. 29.60. —8. Strong gales with rain.—9.30. Discoloured appearance in the water; sounded 57 fathoms. —11. Set reefed foresail; soundings 30 fathoms.—Noon. Gale moderating, but still blowing very hard in squalls, set reefed main sail reefed driver and fore top main stay sail, Bar. 29,69, a sail N. E. ¾ E., Soundings 27 fathoms, Lat. by acct. 16°43 N., Long by acct. 75°58. E.

Thursday November, 2nd.—P. M. Strong gale with a very heavy sea on, ship laboring heavily.—3. shifted fore and main topsail, and set them close reefed.—4. Soundings 38 fathoms.—Sunset. Moderating considerably, sea still very high.—Midnight. Strong breeze and cloudy.—A. M. Breeze decreasing, a very heavy N. W. swell on, ship pitching very deep at times.—3. The ship gave a tremendous pitch completely immersing the stern under water and filling the after cabin, throwing the seacunny over the wheel, and the Chinaman at the lee wheel *underneath* it, the spokes of which jammed him underneath and broke his left arm and fractured several of his ribs on the left side—three spokes of the wheel broke—applied splints to his arm and cross-bandaged his chest.—Daylight. Light airs and cloudy with a high confused swell.—7. The Chinaman who was injured by the wheel departed this life from some injury received from the accident.—9. Out reefs.—Noon. Light breeze and hazy, set top gallant sails, a heavy swell

on; land breeze N. E. to East, soundings 52 fathoms; found the stern galley washed away, Lat. by Obs. 17° 27′ N., Long chr. 72°15 E., current in 2 days 56′ E. ¾ S, Barometer 29.80, Ther. 81.

## *Extract from the Log of the Ship Eliza.*

Tuesday, 31st October.—A. M. Moderate winds and cloudy, the people employed about the rigging altering new main top sail and painting ship, the coolies taking in cargo, the pumps regularly attended to, and squally with heavy rain.—Midnight. Strong S. E. winds and squally.

Wednesday, Nov. 1st—7. Strong winds and squally with rain, people employed about the rigging and repairing main topsail, coolies clearing up the betwixt decks.—Noon. Strong winds with heavy squalls. The pumps regularly attended to.—Midnight. Strong gales with very heavy squalls, accompanied with heavy rain.

Thursday, Nov. 2nd.—1 A. M. Strong gales with very heavy squall.—1·30. The ship began to drive, veered away on both chains to 100 fathoms on the larboard anchor, and 70 fathoms on the starboard anchor.—2. Got in contact with the ship James Turcan, and carried away the iron yoke on the rudder head, the larboard quarter galley, mizen channels, mizen boom, poop rail, stern and quarter davits and stove the quarter boats all to pieces.—2·30 Blowing a perfect hurricane with heavy rain, ship on her beam ends, struck a large Bugalow which immediately sunk, and struck under the counter and against the rudder, and kept so nearly for one hour.—3. The wind veered round to the N. W., still blowing a complete hurricane.—4. The wind inclining to ease.—Day light. Strong gales with very heavy squalls; found that the ship had drifted close to the shore, and that we had only 3 fathoms water; the pumps sounded every half hour during the night, but the ship made no extra water, made a signal for a pilot to shift the ship.—8. The Captain went on shore to send a pilot off.—10 30. Received a pilot from the shore.—11. The weather more moderate, unmoored ship, and dropped out into deeper water.—Noon. Light winds and cloudy.—6 P. M. Came to with the larboard anchor in 4½ fathoms and veered cable to 30 fathoms; the pumps regularly attended to.—Midnight. Light winds and fine.

## *Extract from the Log of the Ship Norwood.*

October 25th. Commenced dark unsettled squally weather with much rain, aud at intervals calm. Lat. at noon by reduction to mer. 11° 17′ N., Long by equal alt. 69°42, and latter part wind flying about from all quarters, calms, &c.

October 26th. The finest day I had for ten days, wind moving about from N. N. W. to N. E., light and calms, Lat. by mer. altitude at noon 11° 48′ N. Long. by chro. 69° 8′ E, latter part also fine with light airs of wind from N. N. W., Bar 29⅞.

October 27th. Fine with light air from N. W.—Noon lat. by obs. 12° 42′, long. by chro. 69° 43′ E., latter part also fine, barometer standing at 29⅞.

October 28th. Thunder and lightning with calms, squalls, and heavy rain, continued so for the whole of the day, Noon.—Lat. by act 13° 21′ N., Long. 70° 29′ E., latter part the same, barometer at 29½.

October 29th. Thunder and lightning with much rain, wind north.—Noon. Squalls, by Lat by act. 13° 57′, Long. 70° 42′, latter part strong squalls N. W.

October 30th. Commenced with thunder and much lightning, wind flying about from all quarters.—Noon. Lat. 14.32 N, Lon. 70° 57′. Latter part threatening.—Midnight. Blew a whole gale of wind from N. W. to S. W. for about 4 hours, and died away calm.

October 31st. At daylight calm, at 8 blew a whole gale from S. E., and continued with increasing fury.—Noon. Barometer ran down fast, wind hauling East. Noon Lat. by acct. 17° 0 N., Long. 72° 0′ E. Latter part gale continued with a full force, Ship under bare poles could not suffer any canvass about. From 6 till 8 more moderate. Barometer going down fast, prepared for more wind; wore ship, and secured every thing against the approaching storm. During the whole of the night it blew an ordinary gale, ship under three close reef topsails.

November 1st—Commencing at daylight, I found I had not been disappointed in my expecting a hurricane, it blew with awful violence, every seaman can better fancy the appearance of a ship in a hurricane or cyclone than I could describe the scene on board the ship Norwood during the whole of this day, no canvass could stand the force of the gale, and very fortunately been prepared, I had all sail handed, the ship managed herself beautifully during the whole gale.—

Noon. Lat. 18° 10', long. 71° 50', the wind or rather more like thunder than like wind, kept hauling to the N. W. and westward until from 6 to 10. I think I never did hear anything in my life equal to the fury it blew, as to see it was quite impossible, I nearly got my eyes beat out endeavouring to look aloft to see if every thing held on. It would be impossible to give a description of things at this time, except I say the ship was enveloped in one flake of thunder and water, both salt and fresh. About 10 at night, the Barometer commenced rising. I looked and watched it close, still doubting its truth, as the gales till raged as violent as ever.—Midnight. The gale abated, made sail, wind from N. W. to N. N. W., having had timely notice by Barometer, and after many years experience as a ship master, I had everything well secured and prepared, still had not the Norwood possessed many good qualities, superior to most ships I have had command of, with all her masts, rigging, spars, &c. of the very best, something must have given out, and the ship would have been dismasted, if not entirely lost.

November 2nd—At daylight every thing looked strange from the royal mast head to the deck, all covered with salt water and brine, with here and there a dead bird stuck fast, having struck in the night against the rigging.—8 Made sail.—11. Saw the high land of Thull.—Noon. Calm off the harbour.—Sunset. Tacked off the light boat, being a stranger to the harbour, and having no chart of it, did not like to run in without a pilot.—Midnight. Hove to till daylight.

November 3rd.—At daylight passed in by the light ship, could not get a pilot. Wind light at noon, came to anchor below the middle ground to wait for a pilot, thought all the pilots had been lost in the gale, as I saw several bodies drift past the ship. At 2 P M pilot came on board—came to anchor at the moorings.

## *Extract of a letter from the Captain of the Ship Glendaragh.*

Yesterday before receiving your Circular I sent you an abstract of my log from China, and there made remarks on the height at which my Barometer always stood. Yesterday it went ashore for the purpose of adjustment, but at 10.30 A M before disturbing, it stood at 30.40.

I regret that taking as I do a very great interest in the law of storms, it is in my power to assist you with so little intelligence.

During the Hurricane the greatest fall of my Barometer was 29.92 at the passage of the centre, it having fallen one-tenth in a very short time, at the commencement of the lull, and rose a tenth again just after first burst of the gale caught us again, but I was so engaged by the H. C. S. Hastings fouling me that I paid no attention to the exact time. My Barometer at noon on the 1st stood at 30 37.

I have to mention that during the whole night I observed but two claps of thunder, one about half past three A M and the other about half past four, but these were very severe.

From accounts given me by the Captains of the "Tara" and the "Alfred the Great," I have also in a humble way been endeavouring to ascertain the course of the Hurricane, and I think you will find that it came off the coast somewhere about Mangalore, proceeded to the N. N. W. till off the Angrias Bank, then removed to the N. N. E. or N. E. by N., for I think where it passed over Bombay there can be no doubt it was travelling in that direction.

## *Extract of a letter from the Captain of the Ship Forfarshire.*

I beg to forward you an abstract of my log as requested, the Baromoter and Thermometer were all taken at noon.

Wednesday 25th October.

| | | | | | |
|---|---|---|---|---|---|
| Latitude | 10° | 47′ | N. | Barometer | 29.80 |
| Longitude | 69° | 53′ | E. | Thermometer | 82 |

Cloudy weather and much rain, Wind from N. E. to N. W.

Thursday, 26th October.

| | | | | | |
|---|---|---|---|---|---|
| Latitude | 11° | 21′ | N. | Barometer | 29.80 |
| Longitude | 69° | 24′ | E. | Thermometer | 85 |

Light Wind from N. W. to N. N. W. with rain and cloudy weather.

Friday, 27th October.

| | | | | | |
|---|---|---|---|---|---|
| Latitude | 12° | 1′ | N. | Barometer | 29.80 |
| Longitude | 70° | 24′ | E. | Thermometer | 85 |

Wind light and variable from N. W. to N. N. W., with rain.

Saturday, 28th October.

| | | | | |
|---|---|---|---|---|
| Latitude | 12° 30′ N. | Barometer | 29.80 |
| Longitude | 71° 22′ E. | Thermometer | 84 |

Light wind and variable from N. N. E., with much lightning all round the compass, and altogether a dirty night.

Sunday, 29th October.

| | | | |
|---|---|---|---|
| Latitude | 13° 32′ N. | Barometer | 29.75 |
| Longitude | 71° 51′ E. | Thermometer | 84 |

Wind E. S. E., with much rain with thunder and lightning all round the compass.

Monday, 30th October.

| | | | |
|---|---|---|---|
| Latitude | 15° 14′ N. | Barometer | 29.64 |
| Longitude | 72° 44′ E. | Thermometer | 85 |

Moderate breeze from S. S. W. to S. S. E., with much heavy rain, thunder and lightning. P. M. Fresh breeze.—Midnight. Strong breeze S. E.

Tuesday, 31st October.

A. M. Strong breeze S. E.—Day light. Decreasing from S. E. to E S. E.

Noon. Saw the Islands of Henry Kennery, and at 7.30 P. M., anchored in Bombay harbour for the night. Barometer 29 60. Thermometer 85.

Wednesday, 1st November.

Moored in our proper place of anchorage at Noon.—P. M. Breeze gradually increasing at 8 P. M. Barometer 29.60, still increasing at midnight, blowing hard from S. E. at 2 A. M., drove on shore at Boree Bunder at 3·30, drove from there to Gibbitt Island Reef, and now a wreck.

The *Tara*.—The storms experienced by this vessel, betwixt the 13th and 16th parallels, appear to have been the gales which prevailed at Bombay, though with greater moderation, at the same dates. They seem to have extended southward and eastward across the peninsula; they were particularly violent at Pondicherry; and are mentioned on the assumption of their being connected with the hurricane, by a correspondent writing from Cochin, whose remarks will be found in a note below.* Betwixt noon on the 30th October, when the *Tara* was in lat. 13° 37′ N., and 4 P. M. on the 1st November, when she ran out to sea, apparently in 19°, she had made about 400 miles of northing or perhaps 450 in all, in about 76 hours, or at the rate of six miles an hour. Now, as the centre of the hurricane was advancing at the rate of sixteen miles an hour, its radius being about seventy miles, it would not have occupied more than ten hours in passing her betwixt the time of the first contact of the northern, and last of its southern limb, and it must therefore have been from the thunder storms she first suffered. The cyclone clearly first struck her at 4 P. M. on the 1st November, or about six hours before it reached the Presidency. As she started next day for Bombay under double reefed topsails at 8 A. M., and reached at 5 P. M., she had run some thirty miles out to sea, and probably lain to some forty miles off shore. Here

* "CALICUT, 2ND DECEMBER 1854.—In a late paper I observe you surmise that the hurricane of the 1st November might have been telegraphed from Mangalore, so that the news would have reached Bombay in time to have given warning of what was to be expected. That this surmise is perfectly correct, I think the undermentioned facts will shew. I happened to be on the coast 270 miles from Bombay. On the afternoon of Sunday 29th, the gale commenced with smart easterly squalls and rain. On Monday 30th wind shifted to south, and blew a stiff gale, with heavy squalls all day and during the night. On Tuesday 31st, wind still southerly with heavy rain, but blowing less than yesterday. On Wednesday 1st, weather evidently breaking, intermittent squalls from south veering to west and apparently traveling north. Day mostly fine but the clouds which have gone up from south to westward and from thence north, form a thick northerly bank indicating foul weather in that quarter, while at the place I mention it was fine, and towards P. M. only a slight shower from noon. I trust that this slight contribution to meterology may not be without its use as showing the very well defined limits of the Tornado."

the first sweep of the hurricane crossed her bows obliquely at 5 P. M. on the 1st; at 11 it lulled as the centre passed considerably to the east of her; and at half-past twelve blew with great fury from N. W., and so continued till 3.30 A. M. on the 2nd. The *Tara* had thus run some fifteen or twenty miles to seaward of the hurricane track—then nearly parallel with and some ten or fifteen miles from the shore; and the gale had been felt by her for about the same length of time as it was experienced at Bombay, and bore exactly the same general characteristics. Her log seems to have been copied by a Native, the word longitude being occasionally used for latitude, and the words sympiesometer and barometer being obviously in may cases exchanged. I have endeavoured to make some corrections where the errors were unmistakable—those about which there could be a doubt I have left alone.

The *Arracan* was nearly two degrees (lat. 17° 24' N., long. 71° 26' E.)—to the south of the *Tara* when the hurricane overtook her from N. N. E., at 9 A. M. on the 1st., the centre of the storm then bearing E. S. E. The wind was now veering to N. N. W., showing that the cyclone was crossing her bows at no great distance, and travelling N. W. By noon it had passed her; by 3 P. M. the barometer had risen, and the wind began to lull. She had experienced very foul weather all the morning and preceding night—such as we had at Bombay from daybreak till the revolving character of the cyclone developed itself..

The *Norwood* was about half-way betwixt the *Tara* and *Arracan* on the morning of the 1st, and about a degree nearer the shore—the one vessel being in 72° 51' E. and 19° N., and the other in 71° 50' E. and 18° 10' N. The *Norwood* only describes the direction of the wind after the hurricane had passed over her to N. N. W., veering round to W., but so as to give us little idea of when the centre passed over her: from her position about sixty miles from shore the track must, from the descriptions of the other ships, have been to landward of her. From the *Norwood* venturing to move along with the gale, probably making six or eight miles an hour, while the hurricane travelled at twice this speed, she continued to suffer from it from 6 A. M. till 10 P. M., —sixteen hours: could she have lain to, it would have blown past her in four or five. It left her at 10 P. M., when she was probably under the parallel of Bombay.

The *Futteh Moobaruck*, from China, was overtaken by the N. W. limb of the hurricane *about* lat. 16° 20' N., long. 72° 30' E., on the 1st, about 8 A. M. Her position is guessed at from the observations of the previous noon, viz. lat. 15° 20' N., long. 71° 51' E. She was by account at noon the following day 16° 43' N., 75° 58' E.* It seems to have left her about 5 A. M. on the 2nd. Her log does not give the direction or changes of the wind: but as it seems to have been nearly uninterrupted, she was probable considerably to seaward of the centre.

The *Steamer Cadiz*, from China, followed the storm. She reached latitude 15° where the cyclone seems to have first made its appearance, at 5 A. M. on

* There must have been a very great error in reckoning longitude here, as this would have placed the ship nearly 100 miles on shore.

the 2nd, about ten hours after it passed, and found none of the ordinary traces of a gale, such as a heavy swell and troubled sky; nor do her instruments, when she was some 200 miles south of it, seem to have been at all affected, and 15° seems to have been its extreme south limit. The steamer *Feroze,* which arrived from Aden at 5 A. M. on the 5th, was probably some 600 miles off shore as the hurricane crossed her path: none of its effects were experienced, and no trace of it discovered by her: so that the ships *Tara*, *Arracan*, *Norwood*, and *Futteh Moombaruck*, forming a line nearly parallel with the shore were probably within ten miles of its centre, and within thirty or forty of its outer limit. To the northward it is defined by the position of the *Carnac* off Bassein, when she ought to have met it; to the north-west by the ghauts beyond Callian. Its shore limits, again, are uncertain; but as we know it did not extend so far as Poona, and as we find no complaints along the Konkun or Malabar Coast, we may fairly conclude that it made but little way inland—certainly not extending so far as the base of the mountains.

These I believe include the log-books of all the vessels, small as their number is, exposed to the influence of the hurricane. The H. C. S. *Feroze*, as just stated, on her way from Aden with the mails, arrived at Bombay at 6 A. M. on the 5th November, and was probably 700 miles to the S. W. of us on the afternoon of the 1st. Her barometer was not at all affected, and she experienced no traces of the gale. The *Carnac* steamer, on her voyage southward from Surat, was off Bassein, twenty miles north of Bombay, at 4 A. M., and though she ought to have met the first segment of the cyclone at about 1, and the second about 7, she experienced nothing but a somewhat troubled sky, with the winds a little rougher than usual.

From all these circumstances put together, the following facts seem very clearly established:—

1.—The Bombay hurricane of the 1st and 2nd November made its appearance suddenly, on the afternoon of the first of these days, its outer edge about sixty miles off shore, and with a perfectly well defined boundary all around its margin extending to about 300 miles south of Bombay.* 2. The course of its centre, which travelled at the rate of fifteen miles an hour, was N. by W., in nearly a straight line, keeping about ten miles off shore. 3. Immediately on passing Bombay, its path took an eastward bend towards Tanna and Callian, leaving Bassein and the islands along shore to the northward untouched. 4. As it approached the Ghauts, 70 miles to the N. W. of us, after traversing a distance of 300 miles in twenty-four hours, it vanished almost as abruptly as it appeared. The centre, in all likelihood scarcely travelled 200 miles: the diameter of the storm circle seems to have been betwixt 100 and 120 miles, and with the gyration or rest of its circumference, the gale at any given point would seem to begin or cease. The following extract of a note from Dr. Impey, then Civil Surgeon, Poona, with the return from the observatories, is all that is known of its manifestations in the Deccan; and beyond the region of its actual sweep the state of the weather and instruments seem nowhere to have been affected by it:—

* My only authority for carrying it so far south is the following—the position the southernmost of the vessels whose logs we have quoted occupied on experiencing it. It is quite possible, at the same time that what was supposed a portion of our hurricane was the thunderstorm of the 29th, 30th, and 31st, October.

"I send you some Wind and Barometer readings for Poona regarding the Hurricane, which want of leisure prevented my doing before.

The wind readings you may depend on, being taken from a self-registering Anemometer. The Barometer readings were unfortunately at long intervals, but are reliable as far as they go. I have not beside me your resumé as given in the *Times*, but your Barometer *began* to sink at 10 P. M.* on the night of the 1st, and to rise about 5 A. M. next morning, our fall commenced at the same hour, but did not recover itself until mid-day of the next—and being on the outskirts the fall was trifling, as we were out of the *burst* of it. As to wind while you went from the E. points by the N. momentarily and back S. E. and as the Cyclone veered off to Western, and at Poona the wind was nearly directly contrary, changing from E. and S. E., to N. W. and W. S. W., where it remained when the hurricane blew over.

*Poona Readings of Wind.*

| | Oct. 30. | Oct. 31. | Nov. 1. | Nov. 2. |
|---|---|---|---|---|
| Midnight to 8 A. M... | S. E. by S. | S. E. to E. | N. to N. W & S. W. | W. S. W. |
| 8 A. M. till Noon...... | E. to S. E. | E. to S. E. | E. to N. & W. S. W. | S. to W. by N. |
| Noon till 6 P. M...... | E, to S. E. | E. E. to E. | W. S. W. | S.W. to W. by N. |
| 6 P. M. till Midnight... | S. E. by E. | E. to S. E. changed at Midnight. | W. S. W. | W. S. W. |

*Bombay Readings of Wind.*

| | | | | |
|---|---|---|---|---|
| Midnight to 8 A. M... | N. N. E. | E.byN.toE.byS. | E. by N to E. S. E. | W. by N. |
| 8 A. M. till Noon...... | N. N. E. | E. N. E. | E. by S. | N. W. by W. |
| Noon till 6 P. M...... | N. W. to S. E. | E. S. E. by S. | E. S. E. | |
| 8 P. M. till Midnight... | N. N. E. to N. | E. to E. N. E. | E. S. E. | |

*Comparative Barometer Readings.*

| Nov. | Hours. | Poonah. | Bombay. | |
|---|---|---|---|---|
| 1 | 10 P. M... ... | 28·014 | 29·085 | Minus preceding day's reading at sun rise, the Bombay Barometer there having been lowest at 5 A. M., rising in Bombay, falling still in Poona. |
| 2 | Sun Rise... ... | 28·054 | —·506 | |
| " | 10 A. M... ... | 28·062 | —·039 | |

That a vast cylinder or disk of air should have been so suddenly set into such violent motion, and come so quickly and quietly to rest,—stopping short in its career at once, without any apparent retarding cause, any diminution of energy or speed, or any communication of its momentum to any other body, is a thing so inconsistent with all recognised laws, that it would seem inexplicable but for a theory, for which I believe we are indebted to Mr. Piddington. The

* The Barometer appears to me to have *begun* to sink at 9 A. M. on the 1st, and though it rose again from 4 P. M. till 8, the descending tide was ·179 betwixt the first two of these hours, the re-ascending one only ·007 a quantity barely perceptible amounting in reality a virtual fall of ·063—the rise due to November being ·070, that of the previous descent ·119. The mercury then in 11 hours falling steadily by no less than ·123, and this accompanied by the other signs seem to me warning enough of the approach of the storm.

great father and promoter of Oriental Cyclonology informs us that cyclones are vast circular disks of air set violently in motion; that though at times of above 1000 miles in diameter—a severe hurricane in the Bay of Bengal always manifesting itself with the utmost distinctness at Bombay—they are of moderate thickness vertically, and of comparatively limited areas. That though the cyclones which rage along the surface of the earth are from their terrible destructiveness those alone with which we concern ourselves, there is the most undoubted reason for believing that there are others, precisely similar in character, occasionally sweeping over our heads in the upper air, indicated by the depression of the mercury and aspect of the clouds, but which never come in contact with the earth at all; and I can see no more reason why these disks thus left unnoticed should not descend or ascend without altering the perpendicularity of their axis—than why the axis itself, when it rests its extremity on the earth, should be restrained from the recurvatures in its path it so frequently pursues.

Supposing this postulate conceded on, the hypothesis that our cyclone was one of these wanderers, the explanation of the most perplexing of its characteristics becomes singularly easy: the great aereal quoit descended, come in contact with the sea northward of Vingorla, and skimming along the surface, and carrying destruction every where in its path, rose again into the atmosphere about Callian, and wheeling its way along in middle air, was brought by degrees to a state of rest by the friction of the elastic medium around it—its own energy diminishing as it mass became diffused by centrifugal force.

The heavy showers that had occurred during thunderstorms of the three preceding days, and violent rain which preceded and attended the hurricane, had thoroughly moistened and softened the ground scarcely well consolidated from the falls which had this season continued with little intermission down to the middle of October, or a month beyond the usual close of the wet season; and the younger of our trees, and more tender of our vegetables, stood comparatively loose in the ground. The younger mangoes in particular, which have few lateral fangs, or anchoring roots and chiefly draw their substance from a long tapering carrot or tap-root, were mostly thrown down flat, inclining westward, as first blown over by the original burst of the hurricane, the second limb of it sending them back to east. Though, when set on their legs, they seemed to have sustained but little harm, many of them had been so injured that they died soon after. The palm trees growing on soft sandy soil, which readily gave way, suffered much; such of them as had anchored themselves fast in the fissures of the rock, sustained but little injury. Generally trees of all descriptions were blown over, uprooted, split up, and torn limb from limb to a very fearful extent. The monkey-breadfruit (Adansonia digitata), from its enormous trunk, and scanty but solid branches, was the only one that escaped: of these however, there are not above a score on the island.

The proportion of our trees which are deciduous—setting palms out of the question,—compared to those which are not so, are in Bombay as six or eight to one; and few of these show their leaves before the new year. In November, though scarcely any of our plants were either in flower or fruit, nearly all of them were in leaf; and at least half the stems of all were stripped, those that remained being torn, scorched, scarified, and injured to such an extent that it seemed difficult to suppose them capable of longer performing their functions to the tree. Plantains, from the size, delicacy,

and tenderness of their foliage, suffered most: their leaves were all split to pieces from the mid-rib outwards, as if combed: within a week they had thrown out new leaves from the centre stem to betwixt two and three feet, of the most delicate tint and texture, the injured portions shrivelling up and dropping off. Within a fortnight of the occurrence of the gale, the whole of our gardens, plantations, groves, and woods burst forth into fresh foliage, as on the appearance of spring—the withered leaves were all got rid of, and new ones substituted in their room; but here the efforts of nature unnaturally called forth, stopped short,—neither shoots nor twigs made their appearance, and the branches once clothed again, everything resumed its general cold weather appearance.

Watching with the utmost care the effect this unusual state of things might have on the ordinary phenomena of the season, I found that the vegetation of April and May was unusually scanty—spring had been anticipated, and when it arrived, was devoid of nearly all its brilliancy: vegetation in general was feeble; the mango trees were nearly without fruit; and many of our most brilliant flowering trees and shrubs failed to show any flowers at all; or, in place of flowering in April and May, deferred this till July or August, when the rains were nearly over.

Passing from generalities to particulars, we may enumerate a few of the more noble of our trees which suffered most.

The *Banyan* (Ficus Indica), when well rooted, and growing near rock, escaped almost scatheless—when found on loose or sandy soil, as along the Marine Lines, they were nearly all blown down; no attempt was in general made to set them up again, and the same remarks hold good of the *Peepul* (Ficus Religiosa), which, like the Banyan, spreads its roots along the surface, and rarely seeks for nourishment to any great depth, unless in rocky fissures, where there is a want of soil.

The *Palm*.—Though we have six or seven varieties of palm on the island, only four require to be noticed as giving any character to our woods—the Palmyra (Borassus flabelliformis,) the Cocoanut (Palma nucifera,) the Date (Phœnix dactylifera), and the Betelnut (Palma gracialis). The palmyra, which is much the tallest of the four, and looks as if incapable of withstanding the tempest, suffered the least. The naked portion of the stem of this tree is from forty to seventy feet in height before the leaves are attained; it is from one and three quarters to two feet in diameter, and varies but little throughout its length, being considerably thicker six or eight feet up than near the surface of the ground. It is nearly straight, and so stiff that it scarcely yields to the strongest breeze. The leaf stalks are from three to four feet in length, and this is probably nearly the dimensions of the leaf itself. The top of the tree, therefore, is an almost spherical clump of leaves, from twelve to sixteen feet in diameter, presenting to the wind a sectional area of about ninety square feet; or say, that by the bending of the leaves when the hurricane was blowing, and the spaces betwixt them, of fifty square feet—on which the force of the wind was at one time about thirty pounds to the square foot, or 1,500 on the tree. That this enormous force at the end of a lever of say fifty feet in length, acting on a purely fibrous root, with scarcely any lateral spread, so rarely effected the overthrow of the tree, shows how firmly it was rooted in the fissures of the rock. The cocoanut is a less tall and much more yielding tree than the palmyra.

But though this palm was in a position to yield to the gale, its hold in the ground seems much less steadfast than that of the other; and the havoc occasioned in Mahim Wood,—a beautiful cocoanut plantation occupying the north-west extremity of the island for the space of three miles, with an area of nearly 800 acres,—was terrible. The soil here is a light sea-shell gravel, of little tenacity, reposing on blue clay, both of recent marine origin,* and affords but a feeble hold to the roots of trees. The Wood exhibited the appearance so often presented by an American forest after a hurricane, of being grooved, or traversed along certain lines of storm. The Betelnut (*Palma gracilis*), the most exquisitely graceful and beautiful of all our palms, chiefly grows in our cocoanut groves, and with them they yielded to the blast,—exhibiting, when prostrate, that wonderful length and tenacity of trunk that makes it seem marvellous how the vast hearse-plume of leaves at the summit can be supported by it. Many of these trees are from 30 to 45 feet in length from the root to the leaves—six inches in diameter at the base, and about four at the top.

The *Mango*.—The general notice of how the mango suffered from the tempest, already given, may suffice. The mode in which some specimens were restored was remarkable. Generally speaking, the young mangoes much exposed, showed no flowers, and yielded no fruit; and this barrenness or want of prolificness seemed very rigidly to follow the laws which guided the storm,—the crop was excellent everywhere beyond its limits. Throughout the greater part of the island of Bombay this was an utter failure: at Matoonga, and still more around Sion, where the wind was slackening, it was defective only. One tree in my own garden,—and single examples will best serve for all,—was split right down the middle, from the fork to the roots, as if by a cleaver, the two segments of the trunk, each with a portion of the top attached, lying opposite ways, in a state of unspeakable wreck, many of the branches being split up like the trunk. It chanced to be a particular favourite: it was a seedling of 1847, grafted in two limbs two and a half feet from the ground in 1849, and yielding fruit in 1851—in 1853 it had ripened a hundred and fifty first-rate mangoes. On the occurrence of the hurricane, the stem was seven inches in diameter, the top branches about fifteen feet high, the spread about eight feet. I had the cloven trunk and split branches bound tightly up with cotton rope, so as to bring the ruptured portions as nearly in contact as possible, lopping off all the incurably injured branches, and staying the tree in all directions. In a month it threw out a beautiful crop of leaves, and in February, the ordinary season, exhibited a respectable show of flowers, and looked perfectly healthy. The bark near the lips of the wound advanced and thickened in the usual way, but one large mass of soft pulpy matter preceded the regular bark, which it resembled. This was by August 1855 nearly an inch in thickness from the outer surface to the solid wood, and about two inches a-head of the old bark. It was soft, and easily punctured; when sliced, its surface was at first a dirty white, which soon afterwards became covered with gouts every here and there of the gum-resin with which the mango bark abounds. The lips meeting from opposite sides of the wound, in about eight months from the original accident, had encircled the tree; but

* See "Geology of Bombay," by Dr. Carter, in the Journal of the Bombay Asiatic Society and the same by Dr. Buist, in the Journal of the Bombay Geographical Society, 1852,—NewerPliocene, Littoral Concrete, and Blue Clay formations.

the ruptured wood had at no time showed any signs of healing; and when my favourite is many years hence cut down, it will be found to have a great black crack near the core out to the eighth ring, from which an envelope of solid wood will surround the whole. The bark is now (10th September) extending itself slowly over the pulp-wood sheathe promising to cover the wound: every now and then it is infested with white ants, which I carefully remove, cutting away the decayed bark, and scarifying it to the quick, so as to stimulate re-generation. The healing process pursued by the branches was the same as that just described for the trunk. The tree yielded in its convalescent state in June 1855 forty mangoes—about a sixth of what it ought to have given; by next season it will I trust be completely cured. The mango is remarkable for the thickness and juciness of its bark, and thence the great facility with which it may be grafted, and the celerity with which injuries in its trunk or cicatrices in branches lopped off, are covered over and healed. I had two mangoes which gave profusion of flowers, and brought their fruit almost to maturity—one of these died in April, and was found rotten from the roots upwards; the other seemed on the point of demise when the rains of June restored it, and it has now all the appearance of a healthy and vigorous tree. Several died a month or two after the gale: all these seemed to have had the tap root injured—some of the trees are now in flower four months before their time. I have given what occurred under my own immediate observation, as furnishing probably a very fair type of the whole of our mango orchards.

The *Acacia fistula*, and the *Poinciana elata* (Bengal Gold Mohur,) our two finest flowering trees, were affected pretty much alike. They blossom in April and May—the second losing its leaves just before its flowers appear, at which time its branches are naked. The *P. elata* is remarkable for the rapidity of its growth. Two of these in my garden were seedlings of 1848, and planted out on the 18th June that year, about a foot in length, and an inch in circumference. Just before the hurricane the bole was nine feet in length, and forty-three inches in circumference, or fourteen and a half inches in diameter half-way up. It had a spread in all directions of fifty feet nearly, its shadow occupying an area of 1,506 square feet. These were stripped of at least two-thirds of their branches, and presented the most unhappy aspect of all our trees. Though their habit is to lose their leaves in February or March and get into magnificent blossom, the flowers dropping off and the twigs shooting out in great luxuriance in June, those much injured by the storm burst out immediately into leaf, and so continued all the season round, refusing to flower and expending all their energies in recovering their strength as trees. In the end of August when full in leaf, they become covered with flowers,—an anomaly in their history; while the few that were in sheltered spots, and hardly at all suffered, pursued their usual course.

The India Rubber tree (*Jatropha Elastica*), though found in most of our gardens, is an exotic in Hindustan. Its roots have such strength and so great a spread that few of the trees were overthrown, though many of them were nearly stripped of branches: most of them were so contorted and twisted about as apparently to loosen or partially detach the bark from the wood, though this only became apparent some time afterwards. During the rains the damaged bark began to blacken and detach itself. Around its margins, along a very considerable portion of the stem, the tree had begun to re-bark itself in the ordinary manner. Where the spaces were too large, or the vital energies inadequate, for this, a thick, black, spongy, leathery mass of the

caoutchouc juice, thickened, apparently by some fungous matter, overspread the surface of the wood, and this was traversed by numberless rootlets, shooting down from the nearest healthy margin of bark from above, towards the lower portion, with which it was connected. In the course of a few months I presume these rootlets will ensheathe the injured portions of the tree like the net-work formed by those of the Banyan, and come either to supply the place of bark, or to be covered over and absorbed by it.

It is not necessary to go further into the convalescence of the denizens of our forests from the injuries inflicted on them in elemental strife,—it may be considered superfluous to have gone thus far; but as I am not aware of the matter having been taken up before, and as it seems of interest that all the most notable of the effects of great atmospheric disturbances should be adverted to, perhaps the present remarks may draw forth observations more worthy of publication than these pretend to be, from parties competent to write on the subject, and where hurricanes of greater violence and longer duration than that of November 1854 have prevailed.

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THE ordinary Monthly Meeting of the Geographical Society took place on Thursday, the 21st December, when there was a tolerable attendance of Europeans and Native visitors.

[Dr. Buist delivered a lecture on the History of Arctic Discovery, and gave a short notice of the Dunds aud the Salt formation in Scinde.—The lecture will be found in a somewhat extended form amongst the papers.]

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THE Ordinary Monthly Meeting of the Bombay Geographical Society took place on Thursday, the 15th March.

W. F. Hunter, Esq., and H. L. Anderson, Esq., were duly elected.

Dr. Buist gave an account of a singular experiment in evaporation where tides make their appearance in the exhalations of the vapour.

Some Notes on a recent journey, through Kattiawar and Guzerat, with specimens, were laid before the meeting by the Secretary.

[The lecture will be found amongst the papers.]

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THE Annual General Meeting of the Bombay Geographical Society took place on 14th May, the Hon'ble A. Malet, Esq., Vice President of the Society, in the chair.

The minutes of the last annual meeting were read and approved of. The Secretary then read the following

REPORT FROM MAY 1854 TO MAY 1855.

The following is the state of our Accounts for the year—it may be superfluous to read them in detail, as they require to be submitted to the Committee on accounts for audit before acceptance.

ANNUAL RECEIPTS AND DISBURSEMENTS OF THE BOMBAY GEOGRAPHICAL SOCIETY FROM 1ST MAY 1854 TO 30TH APRIL 1855.

| 1st May 1854. *Receipts.* | | Rs. A. P. |
|---|---|---|
| To Balance in the hands of the Treasurer.......... | 1,362 0 9 | |
| To do. in the hands of the Secretary........... | 11 7 10 | |
| | | 1,373 8 7 |
| To Government Subscription at 50 Rs. per mensem............ | | 600 0 0 |
| To Annual Subscription of Members.......................... | | 715 0 0 |
| To Interest allowed by the Treasurer........................ | | 64 4 6 |
| To Society's Transactions sold............................ | | 23 9 8 |
| To Philosophical Instruments sold.......................... | | 418 4 0 |
| To Government for Aden Observations........................ | | 4,095 0 0 |
| | | Rs..7,289 10 9 |

| 1st May 1854. *Disbursements.* | | Rs. A. P. |
|---|---|---|
| By Office establishment.................................... | | 600 0 0 |
| By contingencies including printing the XIth Vol. of the Society's Transactions........................................ | | 1,229 8 9 |
| By Treasurer's commission up to 31st July 1854.............. | | 14 14 1 |
| By the Manager of the *Bombay Times* for the printing of the Aden Observations........................................ | | 4,095 0 0 |
| By remittance of £80 in favor of Messrs. Adie and Son, on account of Instruments........................................ | | 795 13 0 |
| By balance in the hands of Treasurer..........Rs. | 502 9 6 | |
| By Secretary.................................. | 51 12 9 | |
| | | 554 6 3 |
| | | Rs..7,289 10 9 |

The money portion of our Treasury is, perhaps, more poorly filled on the present occasion than at any period of the history of our Society, amounting to no more than Rs. 554; but our Assets in the form of sound and saleable instruments of first rate quality gives the following results:—We have seven beautiful Barometers, six at Rs. 70, and one at Rs. 100=Rs. 520. These instruments are always in demand; with 7 Boiled Tubes, for the repairs of broken instruments, at Rs. 12 each=Rs. 84.

ASSETS.

*Instruments on hand.*

| | | Rs. A. P. |
|---|---|---|
| 6 | Barometers, at Rs. 70 each..............................Rs. | 420 0 0 |
| 1 | Silver Scale Barometer with Magnifiers.................. | 100 0 0 |
| 5 | Pairs Adie's Thermometers, at Rs. 13 each pair.......... | 65 0 0 |
| 7 | Tubes, at 12 Rs. each.................................. | 84 0 0 |
| 5 | Sympisometers, at Rs. 55 each.......................... | 275 0 0 |
| 4½ | Dozen Triple Lenses, at Rs. 2½ each..................... | 135 0 0 |
| 4$\frac{11}{12}$ | Dozen Double Lenses, at Rs. 1½ each.................... | 88 8 0 |
| 3¾ | Dozen Single Lenses, at Rs. 1 each...................... | 45 0 0 |
| 4 | Large Pocket Compasses, at Rs. 3 each................... | 12 0 0 |
| 18 | Small do. do. at Rs. 2½ each........................... | 45 0 0 |
| | Total Rs. | 1,269 8 0 |

This brings up our total available Assets to Rs. 1,680—againt which we have a balance due to Mr. Adie of about Rs. 275, leaving a net balance in cash and saleable property in the hands of the Society of Rs. 1,405.

MEMBERS.

Dr. McLennan, Mr. Frere, and Colonel Holland, Vice-Presidents, and Dr. Bremner have returned to Europe.

Colonel Rawlinson has resigned, and Captain Wills is dead—shortening our list for the present—for some of these gentlemen have only temporarily retired,—by six.

Colonel Campbell, one of our oldest and most honoured Members, has re-joined us; and the following new Members have been admitted—and I may, I trust, be permitted to include, though a little prematurely, Mr. Berkley, who comes to ballot next meeting:—

H. L. Anderson, Esq.
Professor Dadabhoy Nowrojee.
W. F. Hunter, Esq.
Narayen Dinnanathjee, Esq.
J. Berkley, Esq.

Five, or including Colonel Campbell, just the number we have lost, of whom we depend on one at least (Mr. Frere,) and expect more to return to us. All these have joined us since October. During the previous half year we had no claims for admission. The following are the Office-bearers for the ensuing year:—

*3 Vice-Presidents.*

Hon'ble J. G. Lumsden, Esq.
Hon'ble A. Malet, Esq.
C. J. Erskine, Esq.

*12 Resident Members of the Committee.*

Professor R. S. Sinclair.
W. P. Adam, Esq.
John Ritchie, Esq.
W. Howard, Esq.
Jugonathjee Sunkersett, Esq.
Dr. E. Impey.
Lt. E.F. T.Furguson, I. N., F.R.A.S.
W. E. Frere, Esq.
Capt. G. B. Kempthorne, I. N.
Cursetjee Jamsetjee, Esq.
Dr. Bhawoo Dajee.
Henry Young, Esq

*Non-Resident Members of the Committee.*

Major G. LeGrand Jacob.
Capt. R. Ethersey, I. N.
Colonel D. C. Felix.
Commander A. F. Jones.
Major J. Jacob.
Capt. A. B. Kemball.
Commander C. W. Barker.
P. W. LeGeyt, Esq.

The following Donations have been received by the Society:—

JULY, 1854.

1—Journal of the Royal Geographical Society of London, vol. 23. Presented by the Society.

2—Annual Report of the Grant Medical College for the Session of 1853-54. Presented by the acting Principal.

3—Selections from the Records of Madras Government. Presented by Govt.

4—The History of the Great and Mighty Kingdom of China, by Juan Gonzalez D'Mendouza. Presented by the Hakluet Society.

5—Report of Israel D. Andrews on the Trade and Commerce of the British North American Colonies, and upon Trade of the Great Lakes and Rivers. Presented by the auther.

6—Greenwich Magnetical and Meteorological Observations for 1851. Presented by the Royal Observatory, Greenwich.

7—Papers relative to the Artic Expedition in search of Sir John Franklin and the crews of H. M. S. *Erebus* and *Terror*. Forwarded by Messrs. Smith, Elder and Co., on account of the Society.

1—Map of the Basin of St. Lawrence.

2—Ditto of the Straits of Florida and the Gulf of Mexico.

3—Ditto of the Eastern portion of British North America, including the Gulf of St. Lawrence and part of the New England States. Presented by Israel D. Andrews, Esq.

Register of an Anemometer and Rain Guage fixed at the Station of Sappers and Miners, Poona, for the months of May and June.

AUGUST.

Madras Meteorological Observations from 1846-50. Presented by Government.

The World encompassed by Sir Francis Drake, by W. S. W. Vaux, Esquire. Presented by the Hakluet Society.

SEPTEMBER.

Bombay Magnetical and Meteorological Observations for 1851. Presented by Government.

Proceedings of the Society of Antiquaries of Scotland, vol. 1. Parts I. and II.

Atlas of Skeleton Charts for the Direction and Force of Winds and Currents, and other Phenomena, in the Arabian Sea, the Red Sea, the Persian Gulf, and the Bay of Bengal. By A. K. Johnston, F.R.S.E. &c.

OCTOBER.

Two copies, Tables for facilitating the prediction of Occultation.

NOVEMBER.

Report of the Bombay Chamber of Commerce, 1853 54.

Essay on the Architecture of the Hindoos. Presented by the Royal Asiatic Society of Great Britain and Ireland.

Journal of the Royal Asiatic Society of Great Britain and Ireland, vol. 16 Part I.

A descriptive Catalogue of Historical MSS. in the Arabic and Persian languages, preserved in the Library of the Royal Asiatic Society of Great Britain and Ireland.

DECEMBER.

Large collection of Charts from H. M. Lords of the Admiralty. Forwarded by the Hydrographer.

Drawn Map of the portion of Scinde, adjoining the Eastern Narra.

Deaths in Bombay during 1853. By the Medical Board.

Results of the Magnetic and Meteorological Observations made at the Royal Observatory, Greenwich, 1852. From the Royal Society.

Journal Asiatique, IV. Serie, Tome XX.

Journal Asiatique, Serie V., Tome I.

Pamphlet on the Coal of Ameerkuntuck.

Statistical Report on the Principality of Kolapoor. By the Bombay Govt.

Meteorological Registers for the months of March, April, May, June and July, 1854.

A large collection of Files of Bombay and other Indian Newspapers from 1800 to the present time, from Messrs. Remington and Co.

Three Bottle Logs thrown overboard by the P. and O. Co.'s steamers *Ganges* and *Precursor*.

The Danish Pilot, 1853.

Sailing Directions for the Baltic Sea and the Gulf of Finland.

Abstract of the Logs of the P. and O. Steam Navigation Company's Steamers to and from Bombay and China.

Remarks on Baffin Bay, 1853.

The Light-houses of the West India Islands and the adjacent Coasts, corrected to August 1853.

The Light-houses, Beacons and Floating-Lights of the United States, corrected to August 1853

The Light-houses on the Coasts and Lakes of British North America, corrected to September 1853.

The Light-houses on the Mediterranean, Black Sea and Sea of Azof, corrected to November 1853.

The Light-houses of Eastern and Western Coasts of South America and Western Coast of North America, corrected to November 1853.

The Light-houses on the North and West Coasts of France, Spain and Portugal, corrected to February 1854

The Light-houses on the British Islands, corrected to March 1854.

The Belgium, Dutch, Hanoverian, Danish, Prussian, Russian, Swedish and Norwegian Lights, corrected to April 1854.

MARCH, 1855.

Smithsonian Contribution to Knowledge, vol. 6. Presented by the Smithsonian Institution, U. S.

Registry of Periodical Phenomena.

Catalogue of the Described Coleoptera of United States.

The Annular Eclipse of 26th May 1854.

Directions for collecting, preserving and transporting specimens of Natural History.

Seventh Annual Report of the Board of Regents of the Smithsonian Institution.

List of Foreign Institutions in correspondence with the Smithsonian Institution.

Washington Astronomical Observations, 1847. By Lieutenant Maury.

Debates in the Convention of California.

Tartar Conquerors of China.

Minutes of Proceedings of the Second Annual General Meeting of the Bombay Association.

APRIL, 1855.

Transactions of the Medical and Physical Society of Bombay, No. 2, New Series, for the years 1853-54.

Bombay Government Records, No. 10, New Series—Memoir on the Sawunt Waree State.

Report of the Portuguese Settlements in India.

Selections from the Records of the Bengal Government, No. 15.

Papers of 1853 and 1854 on the Damoodah Embankments, &c. &c. &c.

Greenwich Magnetical and Meteorological Observations, 1853.

Address at the Anniversary Meeting of the Royal Geographical Society, 23rd May 1853. By Sir R J. Murchison.

Address at the Anniversary Meeting of the Royal Geographical Society 22nd May 1854.

In 1849 the Bombay Government undertook to pay for the printing of the Aden Meteorological Observations, commenced in 1848 at the suggestion of the Society under Mr. Mayes, provided the expenditure did not exceed Rs. 3,000 a year; and two of the Members of Council, Mr. Reid and Mr. Wil-

loughby, both then vice-presidents, stated that Government ought to be very grateful to the Society for undertaking the supervision of Mr. Mayes' operations, in the editing of his Observations. The earlier Observations had been printed in the Reports of the Colaba Observatory, so that unless the labours of Mr. Mayes—in my opinion surpassed in excellence by none of a similarly light-handed establishment—were to be thrown overboard, it was merely transferring the expense from one department to another.

The work having been completed and passed through the press, a misunderstanding arose as to the settlement of accounts; the letter of application for the balance of Rs, 4,095 then due the printers, was unfortunately sent in for payment during my absence, in Europe, and the various changes which had arisen in the different departments of the Secretariat, might naturally have caused the matter to be lost sight of, Government offering Rs. 3,000 as the amount of our claims, instead of the full charge of the publication of the Aden Observations,—their own, not ours—and for which they had at the outset thanked us for taking on ourselves the trouble of editing. Another letter more fully explaining the matter was sent in after my return, when the following very handsome reply was received, granting our request in full:—

No. 351.—Marine Department.

*Bombay Castle, 20th March,* 1855.

Sir,—I am directed to acknowledge your letter, No. 35, dated 2d December last, with its accompaniments, and in reply to inform you, that the Right Hon'ble the Governor in Council has authorized the Paymaster at the Presidency to pay to the Geographical Society the sum of Rupees four thousand and ninety-five on account of the Meteorological Observations the Society has had published, and such further expenses as may hereafter be incurred as the publication of the Observations progresses, provided the whole, including the sum now sanctioned, does not exceed seven thousand rupees.—I have, &c.,

(Signed) T. Maughan, *Lieut.-Colonel,*
*Secretary to Goverment.*

The importance of the auspicious arrangement of this matter was much more momentous than appears on the face of the paper. Mr. Mayes' labours at Aden had long before their completion been referred to in the Philosophical Transactions of London; they had been so highly approved of by the Society that they had presented him with a handsome £25 chronometer. A portion of the tabular part of his work with a mere fragment of a preamble, had been thrown off; the whole was getting ready for publication; and the Society were in the first place liable for the bill, of which, after Government had taken on themselves the rupees 3,000, for which they at once admitted their responsibility, there was still a balance of Rs. 1,095, due, a sum exceeding the whole amount of the money balance at our disposal. Besides meeting this in the first place, the Rs. 2,000 now undertaken to be provided by Government, or so much of it as was requisite to lay the Aden Observations in such creditable form before the world as they required to be placed in for the sake of our own character and in good faith with Government, and these sums together would have put an end to all idea of any publication of our own, and in short have been the death of the Society.

Paralyzed by the bare thought of the possibility of this,—for I never looked on it as more than the barest of possibilities with a Government which through-

out our career had always so warmly befriended us,—the papers read and lectures given were not put to press as delivered, or we should by this time have had an ample volume ready for issue. Now that sunshine once more brightens our prospects, and that our treasury is full to overflowing, we shall resume with vigour and alacrity a task in which our friends at home are anticipating us,—by publishing a lecture,—(and more may possibly follow,) delivered here in September,—but which has not yet appeared in our Transactions though printed entire in the leading scientific periodical of the Northern metropolis.

On my return from England and resumption of my duties as Secretary in August last, I had occasion to report as follows, on finding the Society in the most deplorable condition that could be imagined :—

"We began the year with betwixt 80 and 90 members, we closed it with little more than 70, our list being reduced by 17, or nearly one-fourth in the course of the twelve-month. Out of twenty-four meeting days (betwixt July 1852 and July 1854) there appear to have been ten when there were no meetings at all; one at which the Society seemed to have proceeded with business when the chairman and secretary were the only parties present, an irregularity that appears to have been passed over. On six occasions there were no more than three members present, on six others there were five, once there were six, and on the occasion of the greatest multitude, the chairman might have exclaimed with Wordsworth's little child, 'We are seven.' Our native members, to their credit be it spoken, though forming a very small proportion of those on the list, seem always to have furnished the majority at the Meetings. I have not included the Secretary in my enumeration, he being merely the servant of the Society, present only on compulsion. During these two years there seemed to have been no more than five papers laid on the table—there is nothing to show that any of them were ever read. And the circumstance is fresh in my recollection of paper after paper, such as those which meet with the utmost acceptance at home, being attempted to be read, when the reader was either interrupted by some one remarking that his observations would be studied time enough in the Transactions, or being left, like the Dean of St. Patrick's addressing his dearly beloved Roger, speaking to the President nearly the only auditor left, he most likely remaining like Sterne's starling, because he "could not get out."

It was very clear that a state of matters such as this could not last long; in short—that our body was hastening to dissolution, and could not hope without some powerful and concerted effort being made to maintain itself in existence for a twelve month longer. It was quite plain that a Society could never expect to be attended which could not once in a twelvemonth exhibit as much matter as would furnish a newspaper report, and whose minutes for six months on end ordinarily ran thus :—

"The ordinary meeting of the Bombay Geographical Society was held on Thursday—present, Commander Jenkins, in the chair; Dr. Bhow Dajee, Secretary." [No heed was paid to the regulations requiring three for a quorum, though three was sometimes to be met with.] "The Minutes of last meeting were read and approved of. The following donations were laid on the table." (Then comes a list of some half dozen or dozen works just received. "The Meeting was adjourned." This positively being a stereotype report for half the year.

As I had for twelve years—an unusual period in India to be spared to hold any office—had the honour of being Secretary, a third of that period in days of great renown, inspired by somewhat of self-confidence by what I had seen and the share I had taken in such like things in England a few months before, I determined to make an effort as strong as it was in my power to make it, to prevent a body, once so famous, from going to the wall so ignominously.

The Society at my suggestion kindly got us rid of one great source of nuisance—that of discussing business details, and carrying on petty controversies in open meeting. These were all ordered to be disposed of by Committee out of doors, the Society reviewing or confirming where requisite. As we had no means of compelling men to send us papers, it was resolved that the Secretary should himself provide, or see that without fail there was provided, one lecture at least, of not less than half an hour in length for every meeting, and accordingly the following have been delivered:—

*14th September* 1854.—On the Principal Depressions on the Surface of the Globe.

*19th October* 1854.—On the Chronometrical Survey in 1849-50, by Captain Selby, of the Mud Banks off the shores of Bombay, from Kattiawar to Vingorla, with observations on the water and earthy matter carried out to sea annually from the shores of North Western India, with charts and sections An Exhibition of the various Instruments used in Geographical pursuits, with an explanation of their principal uses.

*16th November* 1854.—On the late Hurricane, with a list of the hurricanes in India, generally for the past century, with a particular account of those which have prevailed in the Arabian Sea, viz. from 1st to 7th November 1783; 1st to 7th November 1799; 8th May 1819; 13th November 1827; 15th June 1837; 31st Oct. 1842; 19th April 1847; and 2nd November 1854.

*21st December* 1854.—On the Arctic Expedition.—On the Dunds and Salt Formation of Sinde.

*15th March* 1855.—An account of a singular experiment in Evaporation where Tides make their appearance in the exhalations of vapour.—On a recent journey through Kattiawar and Guzerat.

Carrying out as far as possible the home custom, we have this season for the first time managed to induce ladies to attend our meetings, and this will we hope, extend himself, until we require to seek for airier and more extended accommodation. The system of discussion following the delivery of a lecture or reading of a paper in home societies, by far the most delightful portion of the proceedings, is beginning to be introduced; and in this every Member of the Society may usually share. There are few things more disheartening, none more encouraging to the Secretary of a Society like this, who is in a manner held responsible to an extent that is sometimes unjust, for the success of its arrangements and the popularity of its position, than the apathy or interest taken in its proceedings by the highest of its office-bearers. On no single occasion save one or two of special emergency,—the present is the third or fourth,—has the gallant Admiral who has presided over us since the Society resumed its vitality, been absent from the chair.

All our lectures have been well attended, some of them very numerously—

the Governor honouring with his presence the first delivered—a still greater honour awaiting it by the reception it met with at home, where it was published entire in the New Edinburgh Philosophical Journal for April, and with the following preface, which I certainly should not have inserted here, but that it is the constant excuse of those who ought to be our most frequent visitors, but never in reality cross our threshold, that they would of course attend lectures if at home, where they would get something worth hearing—at Bombay nothing but rubbish was to be looked for and therefore they staid away :—

"In the following admirable digest, extracted from the *Bombay Times* (Sept. 28th 1854,) it is apparently merely for the sake of simplicity,* and for the convenient starting point, that the author supposes that 'the earth assumed its present character and conformation', either by having 'risen directly,' or 'through a long serious of elevations,' so that the streams that drain its surface and the water in its inland hollows, are the result of one or a series of actions of upheaval, accompanied, however, by 'stupendous disturbances and frightful distortions amongst the rocky beds; which 'must have occurred at the time of their elevations,' these being followed by 'change and commotion' on a minor scale, examples of which occasionally occur even down to the present day.

"Since the revival of the doctrines of Hutton, geologists have been gradually abandoning the idea of vast disturbances and changes caused by the exercise of forces more sudden and stupendous than those of which we have experience; and it is held by many that the surface configuration of existing continents is the result of the complicated action of numerous gradual upheavals and depressions, and long-continued marine and atmospheric denudations; during which through the various epochs of geological time, the same mountain chains were formed by repeated disturbances, strong, though slow in their operations. Hence some of them in their early stages, formed the nuclei of existing continents, while other ancient ranges and tracts of land of continental extent, now form at last part of the bed of the ocean. The existing drainage of the world is therefore not simply the result of recent great changes of the outlines of the terrestrial surface; but the origin of many of our systems of drainage, and perhaps even in some cases of individual rivers must be sought for in disturbances connected with geological epochs, often far removed. The same is true in a minor degree of areas of depression."

Our lectures were interrupted during the month of January by my absence in Kattiwar and Guzerat—since February I have been almost constantly the inmate of a sick room; but having now completely recovered my customary health and strength, I hope to be able to resume them next Meeting, and to continue them so long as they are desired. There is never any fear of want of subjects; I hope I shall not hereafter find so great a difficulty in obtaining coadjutors as heretofore.

CHARTOGRAPHY.—The following lists of Charts and Maps sent out by the Court of Directors, or lithographed or drawn on the spot, has been furnished us by Government. I observe one omission, that of a Skeleton Physical Atlas, projected by me in March 1854, and published by the Messrs. Johnstone of Edinburgh the following June. Of these an ample supply was, I know, ordered by the India House from the publisher—they do not seem to have been forwarded to their destination up to the present time.

* So it was, simply for the sake of simplicity that the illustration was taken. We know that the surface of the earth is subject to continued upheavals and depressions, and one of the former of these may be assumed such as must needs give the condition of things required, without being committed to any length the ordinary doctrines of modern orthodox geology.—G.B.

## *Return of Maps and Charts received from the Honorable the Court of Directors since 1849.—Chief Engineer's Office.*

| Names. | Authors' Names. | Scale. | Remarks. |
|---|---|---|---|
| Map of India shewing the British Territories, and those of the Natives States.................. | John Walker....... | 32·48 miles to an inch. | Engraved. |
| Map of Sinde....... ..................... | Surveyed and collected by the Qr. Mr. Genl's. Department Bombay Army... ... | 10 miles to an inch... | Lithographed. |

## *A Return of the date of the latest received Sheets of the Great Trigonometrical Survey since 1849.—Chief Engineer's Office.*

| No. of Sheet. | | | Of what Country. | Date. |
|---|---|---|---|---|
| 25 | Of the country between | | Ghorabunder, Bancote, Mahar, and Moorbaur....... | March 1851 |
| 26 | Do | do | Soowurndroog, Viziadroog, Wagotun and Kher. | May 1852 |
| 27 | Do | do | Dewghur and Malwan......... ......... ...... | May 1852 |
| 40 | Do | do | Sattara, Kolapoor, Beejapoor and Mohol......... | May 1852 |
| 41 | Do | do | Seeoghur Ghat, Cape Ramas, Lukmeshwur and Kuladgee.......................................... | May 1852 |
| 57 | Do | do | Solapoor, Talikote, Ghunpoora and Hasanabad... | March 1851 |
| 69 | Do | do | Seundah, Jhansee, Bandah and Sulempoor..... | March 1849 |
| 70 | Do | do | Tehree, Saugor, Belhari and Punah........... ...... | March 1849 |
| 88 | Do | do | Futtepoor, Tirhowun, Benares and Atrowlee | October 1853 |
| 89 | Do | do | Birringpoor, Ramnuggur, Singrowlee and Shohgung.................................................. | March 1849 |

## *List of Maps Lithographed at Bombay in the Chief Engineer's Office since 1849.*

| Names. | Scale. | Date |
|---|---|---|
| Map of the Kolapoor Territory.. ................. ...... ........... | Miles to an Inch... ... | 1849 |
| Do Rownaee Talooka............. ......... ................. | 2 Miles to an Inch... ... | 1849 |
| Do Aukola Talooka............ ............ ............... | Do | 1850 |
| Do Sholapoor Collectorate............... .......... ...... | 4 Miles to an Inch... ... | |
| Do Sattara Territory............................ .... .... | Do | 1851 |
| Do Broach Collectorate....................................... | 2 Miles to an Inch... ... | 1852 |
| Do Dharwar Collectorate............ ...................... | 4 Miles to an Inch... ... | 1852 |
| Do Poona Collectorate................. ...................... | Do | 1852 |
| Do Matheran Hill.................... ............ ............ | 1 Furlong to an Inch... | 1853 |
| Outline sketch of the Islands of Bombay, Trombay and Salsette.................. ....... ............. .............. | 2,400 Yards to an Inch... | 1854 |
| Map of the Punt Territories............... .......... ............... | [illegible] Miles to an Inch...... | 1854 |
| Do Sawant Waree and Goa Territories.................. | 4 Miles to an Inch...... | 1854 |
| Do Roads in the Bombay Presidency...................... | 20 Miles to an Inch...... | 1854 |
| Sketch Map of portion of the Bombay Presidency, shewing lines of the Railway proposed by the Bombay, Baroda, and Central India Railway Company............ ............ | Do | 1855 |
| Map of portion of the Peninsula of India illustrative of the Report by Lieutenant Colonel Kennedy, dated 28th April 1854, relative to the Bombay, Baroda and Central India Railway.................................................. | 22 Miles to an Inch...... | 1855 |
| Sketch map shewing the localities of tribes on the frontier of Upper Sinde ......... ........................... | 16 Miles to an Inch...... | 1855 |

| Names. | Scale. | Date. |
| --- | --- | --- |
| Map of the Reewa Kanta | 8 Miles to an Inch | 1855 |
| Sketch Map of the Runn and the countries adjacent | 20 Miles to an Inch | 1855 |
| Map of the Mahee Kanta and part of Meywar and Wangur | 8 Miles to an Inch | 1855 |

*List of Engraved Charts sent out from England to the Indian Naval Draughtsman's Office by the Hon'ble the Court of Directors from 1st January 1849 to 31st May 1855.*

| When received. | Names of Charts. | Number received. |
| --- | --- | --- |
| 1849 & 1850, | Memo: No Charts sent out from England from 1st January 1849 to 31st December 1850. | |
| 1851 Jan. 27th, | Survey of the Island of Ramaseram and Manaar | 40 in Number. |
| | Ditto of West Court of Ceylon, in 4 sheets | 160 in ditto |
| | Ditto of Harbour of Viziadroog or Geriah | 50 in ditto |
| | Ditto of Cochin Harbour and Roads | 50 in ditto |
| | Ditto of Entrance to Red Sea | 50 in ditto |
| | Ditto of Islands Westward of Socotra | 50 in ditto |
| | New Edition of the Laccadive Groups | 50 in ditto |
| June 30th, | Charts · A Survey of Calicut Roads and the entrance to Baypoor River | 50 in ditto |
| | Ditto A Survey of Dewghur Harbour | 50 in ditto |
| | Ditto of the South East Coast of Arabia, 2nd sheet with a Catalogue of Charts | 50 in ditto |
| Sept 29th, | Ditto Entrance to the Red Sea | 30 in ditto |
| | Ditto Island Westward of Socotra | 30 in ditto |
| | Ditto Dewgur Harbour | 20 in ditto |
| | Ditto South East Coast of Arabia, 2nd sheet | 30 in ditto |
| 1852 Feb. 13th, | Ditto of Anchorage of Ratna Geriah | 50 in ditto |
| | Ditto Bay and Entrance of Rajapore River | 50 in ditto |
| | Ditto Pumbaum Pass | 40 in ditto |
| | Ditto Suez Harbour &c | 50 in ditto |
| | Ditto of Coromandel Coast | 120 in ditto |
| | Ditto [illegible]ngah Bay | 40 in ditto |
| Sept. 23rd, | Gulf of Bengal, sketch of the Irawady in 2 sheets, by G. Winsor Lieutenant R. N | 20 in ditto |
| 1853 Jan. 5th, | Chart: A Trigonometrical survey of the Tidal channels of the Indus, from Minora Point to the Kedewary Mouth, made during 1848 and 1849 by W. A. Fenner, acting Master, and Lieut. Grieve I. N., in 3 sheets, with memoirs | 5 in ditto |
| Feb. 4th, | Ditto Ditto Ditto Dittto | 25 in ditto |
| Mar. 3rd, | Ditto of Palks Strait and Gulf of Manaar | 40 in ditto |
| July 5th, | Ditto of the Coast of Pegue and Gulf of Martaban, surveyed by Lieutenant W. Fell, I. N | 40 in ditto |
| 1854 Jan. 16th, | Ditto A Trigonometrical Survey of the Tidal channels of the Indus from Minora Point to Coast of Sind &c. in 3 sheets, with Memoirs | 50 in ditto |
| | Ditto A Trigonometrical survey of the Tidal channels of the Indus from Minora Point to coast of Sind &c., in 3 sheets, with Memoirs | 36 in ditto |
| 18th, | Ditto Gulf of Aden, 2nd sheet | 50 in ditto |
| | Ditto North coast of Sumatra—Acheen Head | 50 in ditto |
| | Ditto Kurrachee Harbour | 50 in ditto |
| | Ditto Coast of Sind and Cutch | 50 in ditto |
| 20th, | Ditto Chronometric survey of the Bombay Bank of Soundings, with Memoirs. By Lieutenant Selby, I. N | 50 in ditto |
| June 29th, | Ditto Arabian Sea &c. By Lieutenant A. D. Taylor, I. N | 50 in ditto |
| Aug. 11th, | Survey of the North and South sands in the Straits of Malacca By Lieutenant C. Y. Ward, I. N | 50 in ditto |

## *List of Charts, Surveys, &c. drawn or lithographed in Bombay from 1st January 1849 to 31st May 1855.—Draughtsman's Office.*

1.—Chart of the island and reefs at the Northern part of the Laccadive Group, with the Padna and Sesostris banks. By Lieutenants Selby and A. D. Taylor.
2.—Ditto Muscat and Muttra Bay. By Lieutenant Grieve.
3.—Ditto Track in search of Challenger Bank. By ditto.
4.—Porebunder roads and creeks, with memoir. By ditto.
5.—Suez harbour, with memoirs. By Lieutenant Barker.
6.—Bunders Khairan and Jessue. By Lieutenant Grieve.
7.—Survey from Ras Jask to Ras el Khore. By ditto.
8.—Ditto Coast of the Northern Konkan from Danoo to Amol island. By Lieut. Ethersey.
9.—Ditto of Angrias bank. By Lieutenant Selby.
10.—Coast of Sind and Kutch. By Lieutenant Grieve.
11.—Gulf of Maseera. By ditto.
12.—Bassadore Roads. By Lieutenant Stephens, I. N.
13.—Soundings in Persian Gulf, with table of revised longitude. By Commodore Carless, Indian Navy.
14.—Khore Jeramah. By Lieutenant Grieve.
15.—Berbera Bay. By ditto.
16.—Gooriya Creek. By ditto.
17.—Plan of Bukeer. By Lieutenant Christopher, I. N.
18.—Mouths of the Sutlej River. By ditto.
19.—Gubet Kumar, South East Coast of Arabia. By Lieutenant Grieve, Indian Navy
20.—North East Coast of Arabia, Trigonometrical. By ditto.
21.—Merbat Bay. By ditto.
22.—Bunder Lusk. By ditto.
23.—Sketch of Hujamree, mouth of Indus. By Ditto.
24.—Tracks of the *Clive* in search of Auckland Bank.
25.—Ditto of *Palinurus* in search of Sir R. Oliver's Bank.
26, 27.—Survey of Malabar Coast from Bombay to Bancoot river. By Lieutenant Cogan, Indian Navy, 2 sheets.
28.—Survey of ditto from Boria Pagoda to entrance of Rajapoor River. By ditto.
29.—Coast of Cutch. By Lieutenant Grieve, I. N.
30.—Survey of the Island of Dew. By Lieutenant Ethersey.
31.—Seer River. By Lieutenant Grieve.
32, 33.—African Coast, in two sheets, from Berberra to Raskel Whart. By ditto.
34.—Chart of North East Coast of Arabia. By ditto.
35.—Gulf of Aden, 1st sheet. By ditto.
36.—Koree Inlet. By ditto.
37.—Eastern Coast of Arabia. By Commander Sanders, I. N.
38.—Working sheet of Arabian Coast corrected. By Captain Haines.
39, 40, 41.—Survey of the Coast of Sind and mouths of the River Indus in three sheets. By Lieutenant Selby.
42.—Cochin Harbour. By Lieutenant Ward, I. N.
43.—Chart of the Gulf of Aden in one large sheet complete. By Lieutenant Fergusson, Indian Navy.
44, 45.—Survey of Coast of Kutch from Vomain Point to below Porebunder, in two sheets. By Lieutenant Constable.
46.—Chart of ditto on Mercator's projection. By ditto.
47, 48, 49.—Survey of Gulf of Kutch, in three sheets large. By Lieutenant A. D. Taylor.
50.—Chart of Gulf of Kutch, in one sheet. By ditto.
51.—Bate Harbour. By ditto.
52, 53.—Survey of Coast of Cutch from below Porebunder to Diu Head, in two sheets. By Lieutenant Grieve.
54.—Chart on Mercator's projection of Cutch Coast from Vornani Point to Diu Head, with memoir. By ditto.
55.—Porebunder Roads, By Lieutenant Constable.
56.—Verawel Roads. By Lieutenants Constable and Stiffe.

57 to 63.—Malabar Coast, in seven large sheets, from Cape Comorin to Calicut. By Lieut. Selby.

64, 65.—Cochin Harbour before and after the monsoon of 1852. By ditto.

66.—Malabar Coast from Newree to Boria Point. By Lieutenant A. D. Taylor.

67, 68, 69.—Coast of Northern Konkun from Vaux's Tomb to Danoo, in three sheets. By Lieutenant Rennie.

70.—Charts of ditto on Mercator's projection. By ditto.

71, 72.—Kurrachee Harbour, very large scale, two sheets, eight inches to a mile, in 1853-54. By Lieutenant Grieve.

73. Ditto, small scale. By Commander Campbell, in December 1849.

74.—Straits of Jubal in the Red Sea. By Lieutenant Fergusson.

75.—Entrance to Gulf of Persia. By ditto.

76.—Track Chart of the Coast of Western India. By ditto.

77.—Chart for making the Port of Bombay. By ditto.

78 to 89.—Wind and Current Charts of the Indian and China Seas, in twelve large sheets. By Lieutenant Fergusson.

90 to 101.—Ditto, ditto Charts for the Red Sea, separate in twelve sheets. By ditto.

102 to 113.—Ditto, ditto Charts for the Persian Gulf, separate in twelve sheets. By ditto.

114.—Coast of Malabar from Cannanore to Waddakunay. By Lieutenant Montriou.

115.—Ditto, ditto from Waddakunay to Puddanguddy. By ditto.

116.—Sketch of Teracole or Penui River. By ditto.

117.—Banks off Bombay. By Lieutenant Selby.

118.—Sketch of anchorages at Onore, Koomptee and of the Meerjee River. By Lieutenant Montriou.

119.—Sketch of Moolky Rocks. By ditto.

120.—Sketch of anchorage off Mangalore and entrance to Koondapou River. By ditto.

121.—Survey of Sadasheer Bay. By Lieutenant Taylor.

122, 123.—Ditto from Kenery Island to Kelnoe Mahim, in two sheets. By Lieutenant Selby.

124.—Sketch of Mahim Harbour. By Lieutenant Taylor.

125.—Malabar Coast from Vingorla to Tiracole. By Lieutenant Montriou.

126, 127, 128, 129.—Malabar Coast from Boria Point to Pigeon Islands, in four sheets. By Lieutenant Taylor, I. N.

130.—Ditto Rutnagherria Bay, large scale. By ditto.

131.—Ditto from Dewghur to Anchera Rivers. By Lieutenant Montriou, I. N.

*Memo.*—The whole of these Charts have been copied in the Indian Navy Draughtsman's Office in duplicate, and many of them in triplicate and quadruplicate to meet the demands of the public service.

For the preceding very valuable lists I am indebted to the Chief Engineer of Public Works, General Waddington, and the Draughtsman of the Indian Navy, Lieutenant Fergusson, the officer in charge of the Observatory. Having been applied to on the subject through Government, they seem to have done everything in their power to meet the views of the Society. When it is remembered that the establishment of the Draughtsman's office consists of one European officer (the Draughtsman, a Lieutenant of the Indian Navy) and two Native Draughtsmen, that its cost annually has of late amounted to no more than Rs. 5,376, or Rs. 448 a month,* the amount of work lately turned

* This, which is taken from the Civil Paymaster's Return, includes material; and Commander Montriou gives the establishment as follows:—

| | |
|---|---|
| One officer of the Indian Navy, in addition to the net pay of his rank......... | 300 |
| One Native Writer.................................................. | 30 |
| Two Native Draughtsmen, at Rs. 45 each.............................. | 90 |
| Total Rupees......... | 420 |

The pay of a Lieutenant, by whom the office is almost always held, is Rupees 180; or in all Rupees 600. Since January 1846, the Observatory at Colaba has always been in charge of the Draughtsman.

out seems surprising. It is much to be regretted that the unsatisfactory state of the art of Lithography in Bombay prevents justice being done to delicate drawings of any description; and lines, names, and figures, when small or delicate, are almost sure to be blurted. The lithographed maps prepared at the Draughtsman's office give a very imperfect idea of the original work. At the establishment of the Chief Engineer the lithography greatly surpasses that of any other establishment in Bombay, but the work is far short of that executed both at Calcutta and Madras, and not to be compared for a moment with the productions of Europe. We have of late years been improving in these respects rapidly, and we shall, it is hoped, continue to improve: that the climate is by no means so inimical to the art as was supposed is obvious from the excellence attained by it in other parts of India. Engraving in steel is unknown to us—on copper the art stops short with a card plate, which costs about five times the price for which it may be procured in London; and considering the economy and expedition with which maps and plans are lithographed at home, I should think, when they were at all minute or elaborate it would be found more profitable to have them executed in Europe than in India. The Draughtsman's office is always kept provided by the Court of Directors with supplies of charts for sale at a charge of from 2s. to 6s. and 10s. a sheet, according to size—a price singularly moderate for London engravings. About fifty copies of each are sent out at a time, and, according to the return furnished by Commander Montriou, the following are the charts sent out by the Court betwixt 1820 and 1849:—

| | | |
|---|---|---|
| Coast of Africa.................... | 4 | Sheets. |
| Red Sea........................... | 7 | ,, |
| South-east Coast of Arabia......... | 4 | ,, |
| Persian Gulf, &c................... | 21 | ,, |
| Sinde, Cutch, and Cambay.......... | 26 | ,, |
| Bay of Bengal..................... | 27 | ,, |
| Martaban and Tenasserim........... | 13 | ,, |
| Straits of Malacca, and China...... | 38 | ,, |
| Indian Ocean...................... | 5 | ,, |
| Total...... | 145 | Sheets. |

or one hundred and forty-five sheets in all. To these must be added thirty-eight sheets enumerated in Lieutenant Fergusson's list, making in all one hundred and eighty-three sheets of charts.

The latest sheet of the Great Trigonometrical Survey that has been received is No. 99; but they are not issued at all in the order in which they are numbered, and earlier numbers have reached, of much later dates—the last arrival being No. 88 in October 1853; Nos 25, 26, and 27 having been sent out in March 1854 and May 1852 respectively.

The lithographed charts and maps are in a great measure compilations for special use or local convenience, and do not for the most part very materially extend our knowledge of Geography.

The chart of Lieutenant Taylor is, I presume, that which has been frequently referred to in our discussions regarding the labours of Lieutenant Maury, and our own track charts for the Eastern Seas,—a wind and current chart for the Arabian Sea, showing the prevailing currents in the sea and air at different seasons of the year,—together with as many surface temperatures as can be collected. It forms a valuable contribution to our knowledge of the physical

condition of that space which intervenes, betwixt Africa and the peninsula of Hindustan, one which commerce to the value of above twenty millions sterling is annually borne. Of the skeleton atlas, the omission of which in the Draughtsman's catalogue is already noticed, it becomes not me to speak. The following are the words of a reference made to it by the Earl of Horrowby when presiding at the British Association at Liverpool in 1854 :—

"Wind and Current Charts have been published of late years, chiefly based on the great work of the United States Government, at the suggestion of and superintended by Lieut. Maury ; and by studying such charts and directions, navigators have been enabled to shorten their passages materially. In many cases as much as one fourth, in some one-third, of the distance or time previously employed. Much had been collected and written about the winds and currents by Rennell, Capper, Reid, Redfield, Thom, Piddington, and others ; but general attention was not attracted to the subject, however important to a maritime country till the publication of Lieut. Maury's admirable observations. Encouraged by the practical results obtained, and induced by the just arguments of that officer, the principal maritime powers sent duly qualified persons to assist at a Conference held at Brussels last year on the subject of Meteorology at sea. The report of that Conference was laid before Parliament, and the first direct result of it was a vote of money for the purchase of instruments and the discussion of observations. All the valuable meteorological data which have been collected at the Admiralty, and all that can be obtained elsewhere, will be tabulated and discussed in this new department of the Board of Trade, in addition to the continually accruing and more exact data to be furnished in future. A very large number of ships, chiefly American, are now engaged in observations ; stimulated by the advice, and aided by the documents so liberally furnished by the United States Government, at the instance of Lieut. Maury, whose labours have been incessant. Not only does that Government offer directions and charts gratis to American ships, but also to those of our nation in accordance with certain easy and just conditions. In this country the Government, through the Board of Trade, will supply a certain number of ships which are going on distant voyages with 'abstract logs' (or meteorological registers) and instruments gratis, in order to assist effectively in carrying out this important national undertaking. In the preface to a late edition of Johnston's 'Wind and Current Charts,' published last June at Edinburgh, Dr. Buist says,—'It has been shown that Lieut. Maury's charts and sailing directions have shortened the voyages of American ships by about *a third*. If the voyages of those to and from India were shortened by no more than *a tenth*, it would secure a saving, in freightage alone, of 250,000*l*. annually. Estimating the freights of vessels trading from Europe with distant ports at 20,000,000*l*. a year,—a saving of a tenth would be about 2,000,000*l*. ; and every day that is lost in bringing the arrangements for the accomplishment of this into operation occasions a sacrifice to the shipping interest of about 6000*l*, without taking any account of the war navies of the world.' It is obvious that, by making a passage in less time, there is not only a saving of expense to the merchant, the shipowner, and the insurer, but a great diminution of the risk from fatal maladies,—as instead of losing time, if not lives, in unhealthy localities, heavy rains, or calms with oppressive heat, a ship properly navigated may be speeding on her way under favourable circumstances. There is no reason of any insuperable nature why every part of the sea should not be known as well as the land if not indeed better than the land, generally speaking, because more accessible and less varied in character. Changes in the atmosphere over the ocean as well as on the land are so intimately connected with electrical agency (of course including magnetism), that all seamen are interested by such matters,—and the acts which they register become valuable to philosophers. Meteorological infor-

mation collected at the Board of Trade will be discussed with the twofold object in view—of aiding navigators or making navigation easier as well as more certain—and amassing a collection of accurate and well-digested observations for the future use of men of science."

GEOGRAPHICAL RESEARCH IN 1854-55.—The great geographical events of the past year are the discovery of the North-west Passage by Capt. McClure betwixt 1850 and 1853, and the return of Dr. Rae from Arctic America, with accounts of the fate of Franklin and his companions; and that of Capt. Collinson, who accompanied Captain McClure to Bherring's Straits. The two vessels had mainly in view the discovery of the missing navigators. An outline of the history of the Arctic Expedition formed the subject of a lecture delivered before the Society in December, and will be printed amongst its papers. The subject itself with the two about to be noticed, have become the property of our great London parent, on whose vast domains it is not permitted us to trespass. For the past seven years much anxiety has been expressed for an extension of our acquaintance with that part of the North of Africa extending from the Gulf of Tadjoura, by which Sir W. Harris entered the country on his way to Abyssinia in 1841, to Cape Guardafui, a magnificent ridge of tertiary limestone mountains, rising to an altitude of 1,800 to 3,000 feet, skirting the shore: a second range, of from 5,000 to 7,000 feet, rising a short distance to the south of them. Here the watershed is believed to occur, and from this the country is supposed to slope inwards down to the river Nagal, 400 miles to the southward, the source of which, near the shores of the Gulf of Aden, seems under 500 feet above the level of the sea. The general character of the rocks, so far as is known, seems the same on both sides alike of the Gulf of Aden, and of the Red Sea, the two Gulfs occupying a vast crevasse created by some tremendous catastrophe, which for the space of nearly 3,000 miles, from Guardafui to Suez, has rent the continents of Asia and Africa asunder. In 1849 the Royal Geographical Society of London moved in the matter; and Dr. Carter, who had just before distinguished himself by his papers on the Geography of Southern Arabia, prepared from materials collected when acting as Surgeon in 1845-46 on board the surveying brig *Palinurus*, under Captain Saunders, and afterwards under Captain Grieve was recommended to be sent on an exploring expedition into the interior. The matter was warmly taken up by Sir C. Malcolm, the President of the Royal Geographical Society of London, under whose auspices our association originally came into existence. As it is on all occasions requisite to carry presents for the Chiefs, the great danger comes to be that the first chief or tribe met in with, may feel disposed to appropriate, in addition to his own lawful share, the gifts intended for others; and this is only obviated by travelling in disguise,—a thing difficult to accomplish, and sure to lead to mischief should the party endeavouring to practise it be detected,—or to have an escort of sufficient strength to defy attack,—this last involving a heavier outlay than societies or individuals are in general disposed to incur. As the localities desired to be examined lay chiefly along shore, Dr. Carter proposed to pursue a zig-zag route at no great distance inland, and to carry with him no more valuables at a time than might be sufficient for a single chief or tribe. A small armed vessel was to cruize along shore, as near as could be guessed to the line of march, so as at once to carry his supplies, and make those who might chance to be unfriendly aware that he had assistance at hand. A plan so feasible did not meet

with the support it deserved, and so fell to the ground—to be resumed in a different form some future year.

The Court of Directors and the Geographical Society having continued to express their anxiety on the subject, our late able and respected President, the Honorable Mr. Willoughby, made in 1851 a careful compilation of all the information on record,* the bulk of which has appeared in our Transactions, on the Somalies and their country, and was most anxious to assist in forwarding the wishes of the home authorities. But at this juncture there appeared no travellers at command such as exactly to meet their views. Dr. Carter's hands were full at the Presidency, and his health not such as to warrant him in embarking on an enterprise where so much bodily exertion and fatigue, and so many privations required to be endured, and the gentleman afterwards selected was in Europe sick.

In June 1854 I found Mr. Willoughby, in his new character of East India Director, as eager and anxious about the matter as he had been before leaving Bombay—throwing on it, as he did on everything he took in hand, the whole weight of his talent and attention; and steadily collecting all the information which could be procured as to the most effectual mode of conducting the expedition, in reference to which as much anxiety was manifested by him as if it had been proposed that he himself should become its leader.

Lieutenant Burton, of the Bombay Army, who had in 1851 published two excellent works on Sinde, and one on Goa and the Blue Mountains (*i. e.* the Neilgheries),† had in 1853 undertaken the task, by the wish and at the charges of the Royal Geographical Society of London, of a journey from Egypt, through Arabia, spending some time at the holy cities and visiting the tomb of the Prophet, returning to India by the Persian Gulf in the end of the year. A proposition having been laid by him before the Bombay Government, to conduct the exploration of the Somali country, the expedition, after due consultation with the home authorities, was decided on, and Lieutenant Burton proceeded to Aden in the beginning of the rainy season. Here he found it necessary to wait for instructions, and the further arrangements deemed necessary for the journey, delayed him till the month of October, when he and his companions crossed over from Aden to Berberra, a considerable town on the southern shore of the Gulf, chiefly dealing in slaves and gum. The party consisted of Lieut. Herne of the 1st Bombay European Regiment, and Lieutenant Speke of the Bengal 46th N. I.

The following account from an Officer at Aden familiar with the whole details of the adventure, gives a much more minute account than I have seen any where else of Mr. Burton's plans and projects. It expatiates more fully on the difficulties to be surmounted than the traveller to whose merits it does no more than justice might have done, and will, I have no doubt, be found correct.

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* The following are the principal papers on the subject:—

Cruttenden on the Somali Tribes of the North-eastern Africa.—Reports of the Bombay Geographical Society, vol. vii., page 3.;—Lieutenant Rigby on.—Ibid, vol. viii.—Lieutenant Rigby's Vocabulary of.—Ibid, vol. ix.—Lieutenant Christopher's account of.—Ibid, vol. vi.—See also works of Bruce, Salt, and Harris.

† The following are the works published by Lieutenant Burton:—Goa and the Blue Mountains. London, 1851. 1 vol. 8vo.—Scinde, or the Unhappy Valley. London, 1851. 1 vol, 8vo—Scinde; and the Races that inhabit the Valley of the Indus. London, 1851. 1 vol. 8vo.—Medina and Mecca. London, 1855. 2 vols. 8vo.

"His intention was, on arrival at Zeyla, with the assistance of the Somali chief Shermachi, to collect carriage and join the first caravan proceeding directly to Hurrur, a country which has never yet been visited by European, although only ten camel marches distant from the coast. With that spirit of adventure which characterises Lieut. Burton he has on the principle of 'taking the bull by the horns' selected a route beset with more than usual dangers, well knowing that if he accomplish this feat he will find African travel easy. The tribes through which he will have to pass are the Dankali and Esa-Somals, savages who profess no religion, both notorious for lawless plunder, little above the Galas in the scale of civilization, and shewing as small a regard for human life. If he manage to escape the perils of the journey,—and I must not omit the lions,—on his arrival at Hurrur he will encounter fresh dangers. The present Amir of Hurrur is a young man, a son of the former old tyrant, and a worthy successor of his truculent father. He holds a firm faith in an old (rather shrewd) tradition that if the Franks see his country they will covet it and take it from him; he entertains a more than paternal dread of all Turks and Egyptians, and sits in Durbar with an exceedingly inconvenient courtier, whose executive duties are easily guessed, holding a naked sword over him. To add to these difficulties, small pox is said to be raging at Hurrur like a plague. Lieut. Burton is by no means the first African traveller who has essayed a visit to Hurrur. As far back as 1841 Dr. Krapf made the attempt and failed signally. Captain Barker, I. N., about the same time was not more prosperous. Mr. Rochel d' Hericourt was obliged to relinquish the enterprize. Lieut. Christopher, I. N., a bold traveller, could not accomplish the object. Since then some R. C. missionaries have tried in vain to penetrate inland from the coast, and latterly Dr. Beke gave up the idea in despair.* It remains to be seen if Lieutenant Burton will succeed where so many distinguished travellers have failed. If however boldness and energy can ensure the desired result, I feel no doubt of Lieut. Burton's success. His plan is judicious. He travels as a peaceable merchant from Hindostan, always a respected character in the East, taking with him two trustworthy Somalis from Aden as his servants, and an assortment of goods such as cloths, beads, hardware, tobacco, &c., for barter or for plunder, as the case may be, and expects if this garb and with conciliating manners to impress the people with respect for his person if not for his property: should they attempt the other thing, of a truth they will find him a bitter gourd. Lieut. Burton's object in visiting Hurrur is to explore a totally unknown country, and to ascertain whether a direct channel of commerce could not be there opened for British enterprise. The soil is reported to be most fertile. On the hills round the populous town flourish the coffee plant, whose produce at present commands the best price in the market, the grape, the khal and the wurras; herbs and gums are also articles of export. Unfortunately Hurrur is also the head quarters of an odious slave trade. No less than 6,000 woolley headed Galas of both sexes find their way thence annually to the Western ports of the Red Sea to supply the Arabian and Egyptian slave markets. Having collected as much useful information as possible on these various subjects, and disposed of, or rather perhaps having been relieved of,



* Aden correspondent, 12th November. I have deemed it right to give Lieutenant Burton's plans, which were perfectly known to the Aden writer, as well as the difficultes to be encountered, more fully than they have hitherto been given. As the first journey was an experiment, the second unsuccessful, it is but fair the difficulties to be faced should be made known.

his merchandise, Lieut. Burton proposes to march from Hurrur southwards to Berbera, to join the other members of this adventurous expedition. Lieutenant Speke of the Bengal army, an enthusiastic sportsman, has already started on the 18th ultimo to fulfil his part in the experimental tour. It is to make his way up the Wady Nogal to ascertain the water shed of the country, a highly desirable problem to solve in a scientific point of view, as according to the latest conjectures Jebel Gumr runs N. and S., not as Ptolemy taught, E. and W. If this hypothesis be corect, the Nile source must of course be sought on the Western versant. Lieut. Speke will in marching employ his gun in collecting specimens of the natural history of the country. He proposes further in making for Berbera—the place of general assembly—to visit a totally unknown country viz. that of the Dhoulbahanta Somalis, and to collect for the final expedition horses and camels of a superior description which are said to abound among this people. Lieut. Speke has adopted the character of a trader for the occasion, and has little to fear beyond hardships and loss of property. Lieutenant Herne will cross over to Berbera about the 15th instant, to make most important enquiries respecting the various caravans frequenting the annual fair, and to discover by which opportunity the expedition can penetrate farthest to the westward. During the spare hours—and they will be many—Lieutenant Herne intends to explore the country in search of coal, said to exist at Kurrum, inquire about and inspect the beds of guano on the Island along the coast, compare the gums, the product of the neighbouring country, with specimens forwarded for that purpose by Sir W. Hooker to Lieut. Burton, and take general observations. When Lieut. Burton joins the two last named members at Berbera, the united expedition will proceed directly westward."

A very important addition was afterwards made to the expedition in the person of Lieutenant Stroyan, one of the best astronomers and surveyors, an intelligent officer of his standing in the Indian Navy.

On the 9th February Mr. Burton returned to Aden, full of hope as to the success likely to attend his next journey into the interior; and again quitted for Berberra in the beginning of April. His intention on this occasion was to proceed nearly due south as far as the Haines river, described by Lieut. Christopher in vol. VI. of our Transactions in lat. 4° or 5° N.—a distance of probably 400 miles from the shore. Having ascended to the altitude of 2,000 to 3,000 feet, the party expected to reach a vast tract of grassy prairie, well supplied with water, abounding with game, and containing a fine breed of horses. To the south of this was the Myrrh country, a region plentiful in water and grain. Their hopes of investigation were, however, marred at the outset; and here I shall again, in absence, or in anticipation of Lieutenant Burton's own account, which may probably first reach us through the London Transactions, quote from Aden letters which have already appeared in the newspapers, the authority of which may be depended upon:—

"Aden, 27th April, 1855.—The fair of Berberra broke up on the 12th of April, the caravan had set out on its return into the interior, and the officers of the Somali Expedition were anxiously awaiting the receipt of letters from Aden to turn their backs on the now deserted huts of Berberra; all were full of hope, in the highest spirits, and impatient for the start. Their camp was pitched on the high ground, on the eastern end of the creek, within a stone's throw of the sea and distant about half a mile from Berberra,—the tents were in one line, Lieut

Stroyan's on the right, ten paces to its left was the rowtee of Lieutenants Burton and Herne, and at a similar distance was the rowtee of Lieutenant Speke, the extreme left of the camp—the baggage was placed between the rowtees on the left, and the cattle to the front, at the foot of the high ground or plateau on which the camp stood. The mission consisted of forty-two souls in all, chiefly Seedees and Somalis entertained at Aden, all were well armed, and abundantly supplied with the materials necessary for the chase, or, if so required, for self-defence. The Ras or Superintendent of the Cafilah was one Mahmoud, a Somali of the Majjertein tribe, better known at Aden as the Balyooz, or the Ambassador, a title that he had probably acquired from having accompained Lieutenant Cruttenden, on his visit to the Somali country, and having often been employed by that gentleman in regard to Somali affairs,—he has the reputation of being one of the shrewdest and best informed of his countrymen, being thoroughly acquainted with the habits and customs, as well as the lands of the different tribes of the Somal. On the 18th of April a buggalow from Aden entered the creek of Berberra, being the sole vessel there, and on the evening of the same day, three horsemen, two of the Essa Moosah—one of them being a near relation of the 'Abban' or protector of Lieutenant Stroyan,—and the third of the Aryal Ahmed tribe, arrived at the encampment of the Mission. At first they were suspected of being spies, or rather scouts, the fore-runners of a Somali raid, but on being questioned, they swore by the most solemn oath, the oath of divorce, that such was not the case, that on the contrary they were friends and well-wishers to the Mission—that the elders of their tribes having heard that a buggalow had entered the harbour at such a late period of the season, were apprehensive that the rumours which had for some time past been current, were about to be realized—viz., that their enemy, the Haji Shamarkie was the third time, about to erect a fort at Berberra, and that the buggalow was supposed to contain the Haji himself, with followers and all necessaries for the rebuilding of the fort, and that they had been deputed to ascertain whether such was the case. Satisfied with this plausible account, the ordinary watches only were set, and the Officers retired to rest, feeling perfectly secure, as much from their solitary position, as well as from the good feeling that had always been shewn to them by the possessors of the soil, the Habarawal. About three o'clock on the morning of the 19th April, Lieutenant Burton was hastily aroused from his slumbers by the Balyooz, who informed him that their camp was attacked; springing from his bed, Lieutenant Burton shouted to Lieutenant Stroyan and informed him of it, and then awoke Lieutenant Herne. Lieutenant Stroyan acknowledged the receipt of this intimation, and at once prepared to defend his tent and property. Lieutenant Speke, aroused by the report of fire-arms, sought the tent of Lieutenant Burton to ascertain the meaning of it, asking on entering, whether there 'was to be any shooting'—Lieutenant Burton relieved his doubts, by his reply of 'I should rather think there was,' which caused Lieutenant Speke to arm for the fray, his weapon being a Dean and Adam's revolver. The Somalis at first attempted to beat down the tents, either by throwing a shower of stones on them, or by beating the 'devils tattoo' on them with their short cudgels;—those inside are not positive as to which of these two processes was tried—the tents once down, all within them would have been speared, but this is an old and familiar Arab custom with which the party were well acquainted, and were not thus to be caught. Lieutenant Herne had already been out and fired two barrels of his Colt into the Somalis, and then returned to report to Lieutenant Burton. Lieutenant Speke next went out, and in so doing received a sharp blow on the knee from a stone thrown at him; placing himself under cover he saw the heads of two blacks within a few paces of him, peeping over some ammunition boxes, but he reserved his fire, not being certain of his aim. Two Somalis crouched down, advancing with their shields before their bodies, their spear poised in their hands, ready either to strike,

or to hurl, next attracted his attention, and at these he discharged two barrels, wounding one of the men ; he then went forward into a crowd of Somalis, who were following in the wake of the two just mentioned, and fired his third barrel, wounding another Somali, but at the same time he received two spear wounds on the shoulder. The deadly revolver was again levelled, and was already within two paces of the breast of one of his assailants, but it would no longer revolve, and a smart cudgel blow over the lungs felled Lieutenant Speke to the ground—whilst down two or three Somalis jumped on him and bound his hands behind his back, and led him away to the rear a captive—and as he then supposed to be slaughtered—here we must leave him for the present. Lieutenant Burton sallied out, scymitar in hand, and desperately wounded two of the Somalis, but was prevented from doing further execution, by a spear being thrust through his left cheek, through the palate, and passing out through the right cheek ; he was thus rendered '*hors de combat*'. Pulling the spear out of his mouth, he made his way out of the Somalis, and in effecting this he was materially assisted by the Balyooz: in retiring from the field, Lieutenant Burton came upon a party of his followers whom he tried to rally, but all in vain ; they had already proved their discretion, though at the expense of their honor and valor. In the mean time Lieutenant Herne was not idle, thrice he discharged his 'Colt,' twice with deadly effect, but the cap failed him in pulling the trigger for the fourth time, and having no sword or other weapon with him, he was compelled to act on the advice of the Balyooz, to beat a retreat, in which he succeeded, knocking about him on all sides with the butt end of his pistol—the Somalis fell back, making a way for him, and allowed him to pass through the midst of them unscathed except from the blows of cudgels. Of Lieutenant Stroyan's further proceedings, unfortunately, nothing is known. His butler states that he saw him fire his revolver six times, but he did not see him fall. There is no doubt but that emulating his brave companions, he offered a most active and determined resistance, during which he received two severe wounds, one on the forehead, from either a stone or spear, which perforated his skull, the other, a spear wound, through his chest—either of these was sufficient to cause instantaneous death—there were five other spear wounds on the body when it was recovered on the morning of the 19th of April. The Balyooz was cool and collected and exerted himself to his utmost to bring off the Sahib logue ; though deficient of the thumb of his right hand, and thus unable to fight, he shunned not the fray, but close by the side of his employers, was in the midst of the Somalis. Of the rest of the native followers a few of the Seedees and a Somali made some stand, in which three of their number were wounded—the rest disappeared on the attack first becoming known. The attacking party is computed to have consisted of from 100 to 150 men, chiefly of the Essa Moosa and Aryal Ahmed divisions of the Habar Awal tribe ; their loss was about six men either killed or wounded—there seems no reason to doubt but that at first, the sole object of the Somalis was plunder, but meeting with such a determined resistance, and some of their number having been wounded, a cry was raised to 'kill the Sahib logue who were killing the Somalis.' With such an advantage in numbers in their favor—namely, fifteen or twenty to one—the Somalis in less than ten minutes obtained entire possession of the camp of the officers. Lieut. Stroyan was dead on the ground, Lieut. Speke was bound and a prisoner in their hands, Lieut. Burton had escaped severely wounded—Lieutenant Herne alone had escaped unhurt—of the others two of the Seedees were lying wounded on the ground, the rest had dispersed. Lieutenant Speke's captor had told him that none of his party had been killed, and that therefore he would not kill him Lieut. Speke begged of him to tie his hands in front of his body, instead of behind his back, as he was in excruciating pain, and could scarcely breathe, and asked for a little water to drink, to both of which requests, his janitor had the humanity to accede, and thus, as the sequel will shew, saved Lieut. Speke's life. Towards day-break on

the 19th, the division of the plunder, estimated at Rupees 15,000, commenced, which had the effect of setting the Somalis fighting and wrangling amongst themselves, spears being liberally brandished in each other's faces Lieut. Speke's captor went to look after his own interests in the division of the spoil; whilst thus alone, a Somali came up and asked Lieut Speke whether he were a Christian or Musselman, adding that if he were a 'Nassarani' [christian] he would kill him, but that if a good Moslem, he would spare his life; he replied that he was a Christian, and that he had better therefore kill him at once, the Somali laughed and passed on his way—he was succeeded by a wretch who tried to spear Lieut. Speke through his heart, but putting up his hands he adverted the blow, and in doing so received a spear wound on the back of the hand. The monster then speared the bound captive in his left thigh. Lieut. Speke seized the spear, but a heavy blow from his tormentor's cudgel, completely paralyzed his arm and caused him to drop the spear. Pausing a little, the ruffian passed over to the other side, then suddenly bringing his spear down, he thrust it clean through Lieut. Speke's right thigh. Seeing that the man was determined to murder him, Lieut. Speke jumped up and rushed towards him, causing his tormentor to fall back in great alarm. Seizing this opportunity Lieut. Speke ran off, and looking round, managed to avoid the spear which the ruffian had hurled after him; a perfect shower of spears from other Somalis were also darted after him, but none touched him; he continued his flight till he found that he was not pursued, when faint from his wounds and loss of blood, he sat down for a few minutes—then hobbling along he fell in with a few of his native followers, and by their assistance he managed to reach the buggalow, three miles distant, being at the entrance of the creek. Lieut. Burton had fortunately at an early period sent to stop this buggalow, then on the point of standing out to sea, and on reaching her himself, he dispatched the crew to the assistance of the party. These brought in the corpse of Lieut. Stroyan, collected the dispersed followers, and such of the baggage of the plundered camp as still remained on the ground. Finding that several of the natives were still absent, Lieut. Burton directed the Nacodah to put into the watering place of 'Seyarah,' but as no intelligence could here be obtained of the missing men, the Nacodah was ordered to stand across for Aden. The officers had hoped to have been able to bring over the body of their lamented comrade for interment at Aden, but decomposition set in so rapidly, that on the morning of the 20th April, they were compelled to commit it to the deep, Lieut. Herne reading the funeral service over it. The buggalow arrived at Aden on the morning of the 22nd instant; the wounded officers were speedily attended to by Dr. Costelloe, and Lieut. Burton was sent home on sick certificate by the Mail of the 25th April. Lieut. Speke is progressing favorably, but his numerous wounds—eleven in all—will necessiate his following his companion to England, and he will proceed by the very next mail. On the 23rd April Lieut. Burton's Moonshe returned to Aden; he had made his way to Antarad and from thence crossed over to Aden. The Somalis of the expedition had scattered and returned to their homes, Lieutenant Burton's servant alone is absent at present, he is said to have gone to Karam, and awaits a boat leaving for Aden."

Another Aden correspondent, under the same date, writes as follows:—

"Towards the close of the year 1854, Lieutenant Herne, 1st Fusiliers, an officer of some industry, and junior member of the African Mission, was detached by Lieutenant Burton to the Port of Berberra, with instructions to explore the country in its immediate vicinity, with a view of ascertaining its mineral and vegetable products. Lieutenant Herne was also ordered to communicate with the different merchants who came with the Caravans, to enquire what were the products of the countries from which the Caravans came and through which they had passed; in short to procure any information which might prove useful or

interesting to the Mission. Lieut. Herne was joined at Berberra by Lieutenant Stroyan of the Indian Navy; the latter officer made some short excursions into the interior, chiefly for sporting purposes, and had some elephant shooting about the end of March of the present year. Lieutenant Speke, an officer of the Bengal army, having landed at some port, about 30 miles from Berberra, proceeded by land to the latter place. Lieutenant Speke had previously been on a shooting expedition in the Dham Boula country, and remained in Aden with Lieutenant Burton till within a few days of his arrival at Berberra.* On the 5th of April, the Berberra party was joined by Lieutenant Burton, chief of the Mission, —the party, with guards, camel men, servants, &c. &c., consisted of about thirty or forty souls, all armed chiefly with fire-arms, and during the continuance of the great annual fair, all seemed to have proceeded smoothly. Lieutenant Burton was so confident, that he officially wrote to the authorities at Aden, thanking them, and presenting that every thing was ready, and that the Mission was prepared to start under the most favorable auspicies after the receipt of Europe letters then hourly expected from Aden. On the 18th April, a buggalow from the Zeylah direction arrived at Berberra, bringing some persons from Aden, who wished to accompany the Mission, and on the same day, three strange horsemen, of the Somali tribe, visited the camp. These men on being closely questioned by the Ras Kaffila, admitted that they belonged to an Okal, one day's ride from the coast, and that they had been sent to ascertain if Shamarkie, the Zeylah Chief was, with the assistance of the English, about building a Fort at Zeylah, adding that a report was also current, that three boat loads of Shamarkie people were in a neighbouring port. On being assured that the English were there only for the purpose of travel, they partook of food, swearing by the oath of divorce, that they were friends; however the Ras Kaffila Mahomed, whom Lieutenant Burton reports to be a man of tried fidelity, was not deceived; he told Lieutenant Burton that these men were spies of a hostile party somewhere near, and advised that every precaution should be taken by planting eight sentries. Unfortunately this warning from so good a source did not meet with the attention it deserved, and Lieutenant Burton felt so secure that he arranged for the following morning a shooting party with Lieutenant Stroyan, and even the common precaution of loading all the fire-arms or placing them and the ammunition where they might be readily found, was neglected. About 3 A. M. the following morning, the Camp was suddenly attacked by a body of at least one hundred men, when all was confusion. Lieutenants Burton and Herne slept in the centre rowtee. Lieutenant Speke's tent was on the right flank, and Lieutenant Stroyan slept on a cot in front of his tent on the left flank. Lieutenant Herne having succeeded in finding a loaded Colt's revolver went to the side from which the attack came, and having fired two shots, he found himself deserted by all his people,—he then retreated to the rowtee, where he saw Lieutenant Burton with sabre, and Lieutenant Speke with a pistol, defending themselves from Somalis who were entering the tent. Lieutenant Herne having again fired two shots with effect—and unable to find his powder flask or secure any weapon, the tent in the mean time falling, it was agreed to make a rush through their assailants. In this Lieuts. Burton and Herne succeeded, but the former in a hand to hand fight received a terrible spear wound through his face. Lieuts. Burton and Herne then separated. Lieut. Speke was not so fortunate, being knocked down wounded and taken prisoner, his hands were first tied behind his back, but one of his

* Subsequent to the preceding being put in type, information of much interest appeared in the Journals of the Bengal Asiatic Society, Nos. iii & iv, for 1855, and as it is doubtful whether we may now have a complete and corrected account of the Somali Expedition, it seems expedient to place in contiguity all we have regarding it even at the risk of altering materially enlarging the report as originally received. The extract will be found at the end of the report.

guards more humane than the rest, tied his hands in front, this proved to him a fortunate circumstance, as fresh guards in the morning attempted to kill him by driving a spear through his chest, and one scoundrel drove a spear through his thigh;—Lieutenant Speke being an active person managed to escape by running away. He received eleven spear wounds. Of Lieutenant Stroyan's fate on that night nothing was known. Lieutenant Burton heard him call out if there was going to be firing, and he told him that the camp was attacked and to get up. He was never seen alive after this. From the deposition of his servants it was ascertained that he had no fire arms near him, and that all his guns were unloaded in his tent, except one barrel of a double gun,—such was the fatal security of the entire party. When day broke Lieutenant Burton with the assistance of the faithful Ras Kaffila and a run-away escaped Aden convict got on board the solitary buggalow, which fortunately for them still remained. He was shortly joined by Lieutenants Herne and Speke. The Nacodah, a person of courage and humanity, shewed them all the attention in his power, and having armed his crew, he landed in search of Lieutenant Stroyan, whom he found just expiring near the site of the camp, his body covered with frightful wounds—the corpse was brought on board, from where it was consigned to the deep; and the buggalow having waited in vain to collect the scattered followers, set sail for Aden where the wounded officers arrived in a miserable condition."

The following is abridged from an account of his journey published in the *Bombay Gazette* of 13th March.

"I left Aden on the 29th Oct. 1854, and arriving at Zeyla after a two days' sail, found that the mules ordered three months before and *paid for*, had not been procured. The Governor, our old friend El Haj Sharmarkay, sent immediately to Tajurrah; but between the delay of catching the animals and a contrary wind which delayed the vessel, I lost at Zeyla twenty-eight days. At last, weary with waiting, I determined to leave Zeyla on foot, when suddenly, on the last day, appeared the vessel bringing the mules.

With four mules and five camels laden with cotton cloth, Surat tobacco, rice, dates and a few handsome tobe or togas intended as presents to chiefs, and a few other necessaries for the way, the Hajee Abdullah, [Mr. Burton's travelling name] attended by the Governor and his son and a detachment of Arab soldiers, passed through the southern gate of Zeyla, and took the way of the wilderness.

In six days the little caravan led by one Raghi, the Elsa Abban, or protector, crossed the plain between the mountains and the sea, travelling from 45 to 48 miles among the Elsa, the most treacherous and bloodthirsty of the Somali tribes. We found them, like all their fellows, a timid race, fearful of danger, skilful at thrusting a spear into a sleeping man, terrible boasters and most importunate beggars. They are rich in flocks of goats and sheep, have large herds of camels and a few cows, but no horses. On the 3rd December, we traversed broken ground, rough and thorny at the foot of the hills, and on the 7th, ascending by a pass even worse than an Aden road, we stood 'above the Ghauts.'

We now entered the Gudabursi Somal, a large tribe whose habitat is between the Elsa eastward and the Girhi to the west. Theirs is the rolling ground, diversified with thorn-clad hill and fertile vale, above the first or seaward range of mountains, and they have extended their lands by conquest towards Harar, being now bounded in that direction by the Harar Prairie.

From the 7th to the 23rd December, I traversed the Gudabursi country, traveling one day and halting five. We were now to enter the Girhi, a hostile tribe, and on such occasions the African custom is, for your friends to detain you and for their enemies to bar your progress.

On the 23rd December I crossed the Marar Prairie. This is a glaring yellow tract of grassy land, about 25 miles wide, running north and south between the

Gadabursi and the Harar Hills. It was desperately cold, 42° in the hut at 6 A. M. and the sun rose to 120° at noon.

On the 27th December we entered the country of the Garad Aden, Chief of the Girhi, a clan of Somali cultivators, whose fertile hills supply all the eastern tribes with jowaree. Here the climate was truly delightful, water freezing at night, and the scenery Alpine, perennial streams, hills wooded with tall pine, deep precipices and mountain flora, the daisy, the thistle, and the sweet briar pleasingly affecting European eyes. After five long marches over roads so rugged that loads are shifted from camel to donkey and back, we entered, leaving with the Garad our goods, a trusty servant and a letter of directions for Lieut. Herne in case of accidents at the celebrated city of Harar.

By dead reckoning, I make Harar 9° 20' N. lat. and 42° 17 E. long. My thermometer boiled at 200° at the level of the sea, 210° showing an altitude of about 5,500 feet. The city like all others in this part of the world is built of mud and rough stone, the granites and sandstone of the hills. It has a dingy appearance, very different from the glaring whitewash of Eastern towns. The houses are flat roofed with small holes for windows, and coarse wooden shutters, large court yards and separate apartments for the women. Almost all, even the Amir s palace, are single storied. There are few trees in the town, and some cultivators' huts shaped like a bell tent, of the kind called 'Gambica.' The population may amount to 10,000 souls. The site of the city is the side of a hill which slopes from west to east; in the latter direction is highly cultivated ground, with gardens of plantains, citrons, limes, the cotton, coffee and kat plants. Westwards are gardens and orchards on a terraced slope. Northwards, a hill covered with tombs, and to the south the city falls into a low valley. It is about a mile long, and at the utmost half that breadth ; the site is very irregular and the streets are like mountain roads.

Harar is a walled town, the defences are in good repair, but no cannon protect the place.

The only public buildings in the place are the wretched domes of the Amir Kur who built the wall, the Shaykh Abadin the 'patron' of the Hararites, and the Zami or Cathedral Mosque which has two queer old minarets, built it is said by Turkish architects.

The present Amir, Ahmed bin Abubekr, is a beardless youth 23 or 24 years old, short, thin and sickly. He is the real African despot, has established strict patrols, hoping thereby to mend his subjects' proverbially bad morals, flogs women, imprisons and confiscates without mercy. He is greatly feared by his people as well as strangers, and at Harar the Arabs, like the Somalis, are, to use their own phrase, viler than earth.

Harrar is the great ' half-way house' for the slaves of Efat, Guragur and the Galla countries. They are driven thence to Berberra and exported chiefly by the subjects of H. H. the Amir of Muscat, in exchange for rice and dates. I am happy to say that even the presence of Lieut. Herne at Berberra has done much, this season, to suppress the traffic, and the Arabs have been obliged to smuggle them out of the country in fear and trembling. An armed pattimar cruising from Met (Burnt Island) to Taguna would put an end to the exportation, and prevent thousands of wretches being torn away from their homes and families, under circumstances of uncommon brutality. It would be a boon to the country were we to take steps in this matter, and commerce would thrive on the decline of slavery. Harar is also the great depot for the coffee, the wars-dye, the admirable cotton, the gums, the tobacco, and the grain of the Galla country around and westward of Harar. The citizens cheat the Bedouins to the utmost of their power, and the Amir has made it penal to buy by weight and scale. Ivory is a royal monopoly. The best coffee comes from Yarjar, a Galla district seven days west of Harar. It has been scarce of late, because it is said the Amir has limited the exportation for fear of diminishing the value of the article. The Tobes of Harar are celebrated throughout this

part of the world; handwoven, they far surpass the produce of our manufactures in beauty and durability. The city has little trade with Zeyla, properly its northern port, owing to an old dissension between the rulers. It sends three caravans every year to Berberra, two small ones in January and February and a large one at the end of the season. The latter may consist of about 2000 men: it stays but a few days on the coast, when business is hurriedly transacted. He who commands at Berbera "holds the beard of Harar in his hand," is a phrase which I heard even within the city walls.

Harar is celebrated for learning, but though *tres repandu* in society, I saw none except in the purely religious sciences. Within the city a language is spoken quite different from the Somali and the districts. It appears like the former to be partly Arabic in Etymology and Grammar, the Semitic scion being grafted upon an indigenous stock. I hastily collected the grammatical forms and a vocabulary, which will, perhaps, afford the learned some idea of this as yet unknown tongue.

The Amir received me fiercely at first, thinking me to be a Turk. At the second interview he accepted a revolver, and he dismissed me after 10 days with the present of a mule for myself and with a letter and a mule for the Governor of Aden. During my stay the two Somalis who had been sent with me from Aden, behaved admirably, both as regards courage and conduct. As small-pox was raging in the town, I found an easy pretext for wishing to resume my journey. These African cities are all prisons on a large scale. You enter at your own bidding—you leave at another's is the native proverb, true and significant. My speedy dismissal was principally owing to a report spread by a Somali from the coast, that three brothers had been sent by Government to Eastern Africa, one (Lieutenant Speke) landed at Makhar, and the second (Lieut. Herne) was waiting for me (the third) at Berberra. There is positively nothing to be seen in Harar; even its Italian climate and Alpine scenery will not compensate for the dangers and difficulties to be encountered among a bigotted people with a barbarous ruler.

Quitting the city on the 13th of January, I passed through in nine days the grasping hands of the Garad Aden, a noted *mauvais sujet* in this part of the world I had promised to meet Lieut. Herne at Berberra before the end of January. Two marches across the prairie convinced me that, if I accompanied my caravan, we should not arrive there before the end of February. Therefore, committing my four camels and one mule to the charge of two women cooks and a one-eyed lad hired at Zeyla, I placed them in the hands of the Gudabursi, telling him that they were Sharmarkay's property, and with half a dozen biscuits, a few limes and lumps of sugar *pour tout potage*, mounted my mule, and with three attendants and a spare animal for the guide, started for the coast.

We took five days and the best part of two nights to finish the distance, which in a straight line must be 180 statute miles. Our hapless mules had to be brought in with the spear. We chose the wildest roads, to save my servants from the hostile Habeawal. The country was the reflection of the northern line over which I travelled, and during two days we did not see a human being. Happily for us it rained almost every night, and thus our animals had water as well as grass. At Berberra I met Lieuts. Herne and Stroyan, who were anxiously waiting my arrival, and a few days of rest and food sufficed to restore my health and strength.

I am now preparing to start southwards at the end of the Berberra fair, with the return caravans. We take with us cloth and provision for a six months march, and pledge ourselves to survey only the Somali country."

Lieutenant Burton, on arriving at Aden, proceeded on sick leave to England, and after a stay of a few weeks, the spirit of adventure still glowing within him,—joined the army in the Crimea. I have dwelt the more fully on the Somali Expedition, not only because of its being composed of Bombay Officers, and by reason of our intimate connection with the country, which supplies Aden with work-people, boatmen, and provisions, but because it is in our own reports that the accounts of nearly all the preceding journeys into it have been record-

ed ; because I believe that entire reliance may be placed on the extracts I have quoted ; and it is more than likely that the accounts of it that hereafter may find a place in the London Transactions will appear in a much more concise and limited shape than the interest they have to us here, entitle them to in a Bombay publication.

Along the eastern shores of Africa from Guardafui southward, there have been no investigations in the course of the past year. Some valuable information in reference to Zanzibar has been published in the London Transactions in a letter from Lieutenant Fergusson, our Draughtsman, to Colonel Sykes ; and there is probably no part of the world where the British Government has so long had a Resident, where there are always some half dozen of European merchants and planters, of which we know so little, as of the capital and part of the kingdom of one of the most faithful of our allies ; with whom we have for half a century (since 1804) been on terms of intimacy. The trade, export and import, betwixt Bombay alone and the eastern ports of Africa amounts to £300,000, with the other ports of Western India to about half as much more. With Zanzibar itself we have traffic to the value of a quarter of a million sterling a year ; yet, of a territory within a fortnight's sail of us we scarcely know more than we do of much of Central Africa, infinitely less than we do of the shores of the Icy Sea. The great bulk of our information, such as it is, in reference to Eastern Africa is derived not from geographers or travellers but for the missionaries. Southern Africa is opening up a magnificent field for discovery; but the explorations of the country around the Great Lake have fallen to the lot of travellers from England, and their narratives have already appeared elsewhere, and do not come within the proper field of the present review.

Surveys in India.— We have of late years fallen behind in our noticies of the geographical observations at our own door ; and I shall preface the notice of what has been accomplished since our last Annual Meeting, with a short outline of our explorations by sea and land for a considerable period of years past.

*Marine.*—The Augustian age or perhaps it would be more apposite to say the Naerchean age of marine investigation was betwixt 1822 and 1838. There was then a Surveyor General at Calcutta, with a large and efficient establishment, with Marine Boards at Calcutta and Madras the former extinguished in 1843; an active and well-paid, though not a numerous body of officers constituting the Bombay Marine. Capt. Daniel Ross, a former President of the Society, a portrait of whom decorates our rooms,—a name only second to that of Horsburgh, in Oriental hydrography,—from 1828 to 1833, when he came to Bombay, as Marine Surveyor General carried on that magnificent set of surveys extending from the mouths of the Hooghly round the western shores of the Bay of Bengal, and so extending through the Straits of Malacca to that portion of the China Seas which formed the highway of British commerce. It was then that the shores and estuaries to the north of us,—the Persian Gulf and the Red Sea were examined, so that at length discovery began to diminish not only from waning energy but from the limited area left to be explored.

Confining myself to the surveys carried out under the Bombay Government, I may start with that of the Persian Gulf, executed betwixt 1820 and 1831, under Lieutenants Brucks, Haines, Cogan, Guy, and Rogers. The results of these various surveys, were embodied in twenty-four sheets of charts, which seem to have been published with a degree of celerity to which we have of late been strangers. The Persian Gulf charts have, I believe, been of late con-

sidered less full and perfect than could have been desired; and in 1853 Lieut. Constable was proposed to be employed to revise the portions deemed most imperfect. I am not aware whether or not the proposition was ever carried out.

Simultaneously with the examination of the Persian Gulf, surveys were executed of the harbours of Rajpore, Viziadroog, and Deoghur, with the adjacent coasts of Bhowleearee and Soonderye creeks, and the Gulf of Cambay (1823); of the Coast of the Southern Concan, from Boria Pagoda to the entrance of Rajpore river, with Bancoot river, and surveys of the rivers of Nagotna, Penn, and Apta, in the Bombay harbour, and of the shore from Bombay to Bancoot, including that of the Panwell river.* The results of these surveys, which sweep around from Colaba out to sea, and so to the southward to Boria Pagoda, are I believe still unpublished. Captain Horsburgh had executed a survey of the Arabian Sea from lat. 10° S. to Suez, and from long. 39° to 63° E.—*i. e.* from the head of the Red Sea to the entrance of the Persian Gulf betwixt 1810 and 1812. The charts were published in 1816, a second edition of them, revised from later surveys, having appeared in 1846. In 1830 the survey of the Red Sea was resumed, under Lieuts. Moresby and Carless, and continued under these Officers and Lieuts. Haines, Pinching, Grieve, Jones, and Barker, for the next seven years. The results were embodied in seven sheets of charts, published betwixt 1836 and 1844—the general outline of the sea occupying the principal charts appearing at the earlier of these dates, just as direct steam communication with Europe was being arranged. In 1838 Lieutenant Carless surveyed the Coast of Africa at the south-western entrance of the Gulf of Aden, from Ras Gulwainee to Ras Heffoon, laying down the coast towards and above Guardafui,—a locality so dangerous to shipping during the south-west monsoon, as manifested by the loss of the *Memnon* in 1843, and the all but loss of the *Bentinck* in 1845. The charts were only published in 1848. In 1830 the coasts of Socotra, a large island opposite Guardafui at one time used and meant to have been retained as a coaling station, was surveyed by Lieutenants Haines, Wellsted, and Saunders, as was the coast of Arabia from the Straits of Babelmandeb eastward.

The surveys of the Red Sea were, in so far as they yet extend, completed with the survey of the Gulf of Tadjoura, and the coast south-west of the Straits of Babelmandeb, by Captain Barker, and of the African Coast half way up the Red Sea, from Cape Jarne to Sayra, by Lieutenant Christopher, both in 1841. Suez Roads were afterwards made by Captain Carless, and subsequently by Lieutenant Barker.

Betwixt 1839 and 1844 survey operations were in a great measure suspended—on their resumption the survey allowances of the officers employed were found to have been retrenched, and the number allowed on board each ship greatly reduced. So far was this most unwise species of economy carried that Dr. Carter, on his numerous inland and along shore examinations, while Surgeon on board the *Palinurus*, in 1834-35, which afforded such invaluable results, had to pay his own boat hire, the ship's boat being engaged on duty, and it seemed as if it was meant to be intended that from henceforth a survey

* For nearly the whole of the information from 1822 to 1848, I am indebted to the Parliamentary Returns moved for by Mr. Hume in 1849—forming a scientific Blue Book suited for the same shelf with that of Colonel Waugh in reference to the Great Trigonometrical Survey which will come by and by to be referred to. The part of the papers supplied from Bombay by the Draughtsman of the Indian Navy, Commander Montriou, is at once the largest and most valuable.

should be confined to the narrowest possible limits,—the laying down of longitudes, latitudes, bearings and soundings, and nothing more;—even these were to be restricted to the most coarse and vulgar of the appliances of navigation. The extension of the borders of knowledge, or application of science beyond the limits referred to were not deemed worthy of a thought.

Since 1844, the *Palinurus*, *Taptee*, *Nerbudda* and *Mahadeva* have been pretty constantly employed in survey service.

It was in the beginning of the year just named (1844) that the survey of the Coast of Arabia, discontinued in 1837, was recommenced, with one brig and one cutter under Lieutenant Saunders. Operations commenced at Morbat, near the entrance to the Persian Gulf, and were continued to the westward. Next year it was taken up, and carried from Ras Morbat to Ras Segar, and between Ras Fartak and Messinah. Here the labours of Captain Saunders in the Survey Department ceased: bad health compelled his return to England, and though he served several years afterwards in India, he was never again vigorous enough for active duty afloat. He died in 1848.

In 1845 Lieutenant Hamilton, of the H. C. steamer *Sesostris*, on his way from Bombay to Aden, passed over a shallow about sixty miles northward of the extreme point of the island of Socotra, in twenty-four fathoms water: he crossed it on his return with seventeen fathoms, and it received the name of the Sir R. Oliver Shoal. An account of these investigations was prepared and lodged in the Marine Office. In 1848 a brig and a cutter, under Lieutenants Grieve and Ward, were employed for some months in searching for the shoal: their examination extended along about seventy miles of coast, and over an area of 4,000 square miles; and in 1850 the charts of the islands to the westward of Socotra, then also examined, were published, on a sheet 40 by 26 inches, on a scale of 6.2 inches to the mile.

Gulf of Cambay.—A very excellent survey of the Gulf of Cambay executed by Lieutenant Ethersey in 1834-35, and 36. His first operations was extended from Diu Island to Goapnath Point, along the Kattiawar Coast, and so along by the west side and head of the Gulf as far east and south as Surat. He examined and laid down the debouchures of the great rivers Saburmuttee, Mahee, Dhadur, and Nerbudda; in the case of the latter examining as far up as Broach. He had on this occasion the opportunity of witnessing for two successive seasons the extraordinary appearances presented by the Bore, afterwards excellently described by him in our Transactions. Lieutenant Ethersey left unsurveyed sixty-five miles of coast-line between Domus and the mouth of the Taptee and St. John's, and again between Bassein and Bombay. The examination of this having been allowed for fifteen years to lie over, was resumed by Lieutenants Rennie and Constable in 1850, 1851, and 1852. These able Officers not only laid down the coast-line with labour and accuracy, but sounded with the utmost care and minuteness to determine, if possible, whether silt or sand had accumulated since the date at which the principal soundings had previously been taken. Lieutenant Rennie took with him the Dip circle belonging to the Geographical Society, and with it made a large number of observations on vertical declination at Vaux's Tomb. I endeavoured at this time to get the Tide Gauge, forwarded to Porebunder by the Society in 1849, and lying there idle ever since, put in order and set to work, and to have a second gauge established further up the Bay with the view of assisting the succeeding operations on the Survey. On both points my efforts were unsuccessful—the determination of the tides, on which such stress was shortly

afterwards laid by the Officers of the Great Trigonometrical Survey, who have at length got a gauge at work at Kurrachee, being apparently considered immaterial in an enquiry on the depths of the bay, the exactitude of which must in a great measure depend on the minuteness of our acquaintance with the rise and fall of the tides! Lieutenant Rennie's survey extended from Vaux's Tomb to Danoo, a distance of sixty-one miles: it has not as yet been engraven—it stands in the list (page lxxi.) as copied or lithographed, it is not stated which, at the Draughtsman's Office, in three large sheets. Lieutenant Ethersey had in 1836 resumed his survey at Danoo, and continued it to Arnol Island, a further distance of thirty miles to the southward, terminating at the northern shore of the Island of Bassein, thirty-four miles north from Bombay Lighthouse. Here Lieutenant Rennie once more resumed his observations, continuing the enquiry down to Bombay.

On the north-western shore, along the Coast of Kattiawar, the survey was conducted by Lieutenant Constable from Vornani Point to below Porebunder; drawn or lithographed in two sheets (lxx.) with separate charts of Porebunder and Verawul Roads: a previous survey had been executed by Lieutenant Grieve from Porebunder to Diu Head, and from this to Vornani Point. Lieutenant Ethersey, who, as already stated, had commenced operations on the western shore of the Bay in 1834, had finished a separate chart of the Island of Diu, not hitherto engraven. Lieutenant Whitelock had in 1833 surveyed from this point westerly round as far as Dwarka—this chart was published in 1835. The entrance to the Gulf of Cutch was surveyed by Mr. Jones midshipman—now a commander, and for many years distinguished for his papers on Mesopotamia, published from time to time in our Transactions. The exertions of our Surveyors were now to be transferred to the northward, and will be found chronicled under the heads Sind and Mekran; and for the next seventeen years the information collected in reference to the shores of Kattiawar and Cutch was deemed sufficient.

In 1850 Lieutenant Taylor was appointed to survey the Gulf of Cutch, and a portion of the sea coast of Kattiawar. It had been before surveyed by Lieutenant Middleton in 1821, but the chart, which had been published the following year, was not considered sufficiently copious or precise for the requirements of navigation, considering the vast increase of our intercourse with these shores within the past thirty years. The work occupied a couple of years, and was completed in April 1852. The contour of the coast formed in this case an insignificant portion of the toil of surveying—the whole chart is one mass of soundings—the figures being dotted nearly as thick as they can stand. One of the main objects of the minuteness of this inquiry was to discover a harbour of refuge where vessels might find shelter in a storm; and in waters so shallow and channels so intricate it was of the utmost importance to lay down tracks for their guidance so unmistakeable that the most ordinary care should enable them to be found. In this Lieutenant Taylor was perfectly successful, Bate furnishing a place of refuge no storm could assail. Lieutenant Taylor's chart was accompanied by a memoir which it would have been desirable to have placed before the world as speedily as possible, irrespective of the inquiry to which it was meant to furnish a companion—neither copperplate nor letterpress has as yet seen the light. The currents off these shores have of late assumed peculiar interest, from the powerful indraft from the west of twenty-three miles a day, from a distance of at all events of 300 miles out. Two fine steamears have been stranded on the Kattiawar coast, probably from this cause, and now that so many of the marvels of the sea begin to be

connected with evaporation, it would be curious to know whether the great salt-pan the Gulf and Run of Cutch produce, with the shores adjoining, which covering an area of 20,000 square miles, probably afford an evaporation of not less than five feet annually in excess of the rains which fall, or close upon thirty cubic miles of water—the Indus just to the north feeding the drain, by pouring its 30,000 cubic miles of water annually into the sea, with mud sufficient to build up an island of twenty-two miles long, forty-seven miles broad, and forty feet deep, or supposing these last figures to represent our mean altitude, thirty times the size of Bombay every inundation.*

SIND.—The mission of Sir A. Burnes to the Court of Lahore in 1831, though professedly a purely complimentary embassage, now appears, from the published papers of Lord Metcalfe, to have had objects in view much more important than those set forth, and of a very different character. Under the cloak of a purely friendly mission, a survey of the Indus, with all the information, political and statistical, that could be come by, was to be secured.†

* Wood and Lord state the maximum discharged in August at 446 080 cubic feet per second—the minimum, in December at 40·857 cubic feet; the total amount of discharge at 150,212,097·542 tons avoirdupois; and assuming 470 940 tons of water to the cubic mile, Wood and Lord's figures will give something more than the sum set down. I have all through preferred cubic measure to weight, as being the easier apprehended of the two.

† Burnes himself gives the following as his instructions, which are alluded to in the text, as declared in the publication of Lord Metcalf (see *Calcutta Review* June 1855, p. 262), the strong, the high-minded, and, as it proved, well grounded opinion of one now recognised as the first statesman of the age on a measure then viewed with general approbation and never fully comprehended by the world at large:—

"In the year 1830 a ship arrived at Bombay, with a present of five horses from the King of Great Britain to Maharaja Runjeet Sing, the Seik chieftain at Lahore, accompanied by a letter of friendship from his majesty's minister (*a*) to that prince. At the recommendation of Major General Sir John Malcolm, then governor of Bombay, I had the honor of being nominated by the Supreme Government of India to proceed on a mission to the Seik capital, with these presents, by way of the river Indus. I held at that time a political situation in Cutch, the only portion of the British dominions in India which borders on the Indus. The authorities, both in England and India, contemplated that much information of a political and geographical nature might be acquired in such a journey. The knowledge which we possessed of the Indus was vague and unsatisfactory, and the only accounts of a great portion of its course were drawn from Arrian Curtius, and the other historians of Alexander's expedition. Sir John Malcolm thus minuted in the records of Government, in August 1830:— 'The navigation of the Indus is important in every point of view; yet we have no information that can be depended upon on this subject, except of about seventy miles from Tatta to Hydrabad. Of the present state of the Delta we have native accounts, and the only facts which can be deduced are, that the different streams of the river below Tatta often change their channels, and that the sands of all are constantly shifting; but notwithstanding these difficulties, boats of a small draft of water can always go up the principal of them. With regard to the Indus above Hydrabad, there can be no doubt of its being, as it has been for more than two thousand years, navigable far up.' In addition, therefore, to the complimentary mission on which I was to be employed, I had my attention most specially directed to the acquisition of full and complete information regarding the Indus. This was a matter of no easy accomplishment, as the Ameers, or rulers of Sinde, had ever evinced the utmost jealousy of Europeans, and one of the missions which visited the country had been permitted to proceed beyond their capital of Hydrabad. The river Indus, likewise, in its course to the ocean, traverses the territories of many lawless and barbarous tribes, from whom both opposition and insult might be dreaded. On these matters much valuable advice was derived from Lieutenant-Coloned Henry Pottinger, political resident in Cutch, and well known to the world for his adventurous travels in Beloochistan. He suggested that it might allay the fears of the Sinde govern-

(*a*) Lord Ellenborough, then President of the India Board.

The arrangement was suggested or warmly seconded by Lord Ellenborough, then at the head of the Board of Control, and Lord William Bentinck, then Governor General of India. How little could either nobleman have foreseen the results that were to arise from it. The Affghan War, that placed the traveller all but at the head of authority, and then proved fatal to him; the annexation of Sind and conquest of the Punjab, all evidently the unforeseen fruits of the mission of 1831. Lord Metcalfe, then Member of Council, pronounced it a trick unworthy of the Government of England. It is, however, with Geography, not with Politics, that we have to deal, and no single adventure of the present age tended more to extend this branch of knowledge than the first journey of Burnes through Sind, Punjaub, and thence through Affghanistan and Bokhara. While the ultimate results, geographically speaking, have been to seal up countries hermitically against the traveller, our policy in 1838 having from the moment our troops returned rendered the country inaccessible to Europeans. It was on the occasion of Burnes' second mission, in 1836, consequent on the first, that the operations of military surveying began. Lieutenant Wood having conducted the examination of the river as high as possible, accompanied Burnes as far as Cabool, and then pursued his own researches in Transoxonia, Lieutenant Whitburne was left behind in Lower Sind to report on the nature and extent of the inundation. In the beginning of 1837 the entrance to Kurrachee Harbour was surveyed by Lieutenants Carless, Shepherd, and Grieve, who extended their operations to Sonmeeanee, the harbour of which they surveyed also. Much valuable information was on this occasion forwarded by the head of the Survey to the Society, not only in reference to the singularities along shore, but in regard to the places visited in the interior, especially the springs at Muggur Peer, and the singular formations around. Sonmeeanee Harbour was afterwards surveyed by Lieutenants Montriou, Frushard, and Fergusson in 1842, their charts being published the year afterwards.

Lieutenant Carless' survey was extended eastward to the mouths of the Indus, and westward to Sonmeeanee Bay, published in 1850. The mouths of the Indus and part of the Coast of Sind was re-surveyed by Lieutenant Selby in 1839. The charts of none of these seem hitherto to have reached the Draughtsman's Office. The brig *Palinurus*, and her tender the *Nerbudda*, were employed in the end of 1848 and beginning of 1849 in completing the portions of the coast-line of Sind and Cutch hitherto partially or imper-

ment if a large carriage were sent with the horses, since the size and bulk of it would render it obvious that the mission could then only proceed by water. This judicious proposal was immediately adopted by Government, nor was it in this case alone that the experience of Colonel Pottinger availed me, as it will be seen that he evinced the most unwearied zeal throughout the difficulties which presented themselves and contributed in a great degree to the ultimate success of the undertaking. That a better colour might also be given to my deputation by a route so unfrequented, I was made the bearer of presents to the Ameers of Sinde, and at the same time charged with communications of a political nature to them. These referred to some excesses committed by their subjects on the British frontier; but I was informed that neither that, nor any other negotiation, was to detain me in my way to Lahore."—*Burnes' Bokhara.*

"The depth of water in the Indus, the direction and breadth of the stream, its facilities for steam navigation, the supply of fuel on its banks, and the condition of the princes and people who possess the country bordering on it, are all points of the highest interest to government: but your own knowledge and reflection will suggest to you various other particulars, in which full information is highly desirable; and the slow progress of the boats up the Indus will, it is hoped, give you every opportunity to pursue your researches"—*Ibid*, p. 4.

fectly surveyed, including in their explorations the creek and anchorage of Porebunder off the Kattiawar Coast. The tidal channels between Minora Point, Kurrachee Harbour, and the Kedwaree mouth of the Indus were at the same time surveyed by Mr. Ferrer, Acting Master. His charts were published in 1853.

MALABAR COAST.—It is, perhaps, a singular illustration of the adage, that while we seek for information regarding places at a distance, we are often content to remain in ignorance in reference to what is at our doors, that for twenty years after we had prosecuted our surveys within the shores of the Persian Gulf and Bussorah, and straits and channels amongst the islands in the Malayan Archipelago, we submitted to remain in ignorance of the Malabar Coast. Captain Cogan's survey of the coast in 1828 comprised an examination of Bombay Harbour, and extended as far south as Bankote River,—from thence to the southward no systematic or trustworthy survey seems to have been thought of for the next sixteen years. In 1844, the *Palinurus*, in charge of Lieutenant Montriou, was sent on survey southward, and in the course of this and the following year completed the examination of Kari Pultun, or Viziadroog,* and Tiracoll Rivers and Harbours ; Algoada Roads, the Coast from Malwan to Algoada, with the Burnt Islands or Vingorla Rocks. In 1846, a small cutter was added to the survey establishment, and operations carried on along the shores of Malabar and Canara, Cawar, or Sudasheoghur Bay and River ; the anchorages off Mergui, with part of the river Onore ; Mangalore, with the coast line from Mount Dilly to the Beypoor River ; Ayadeva Island, with the coast adjoining, with the entrance to the principal rivers from Algoada to Beypoor River.

From betwixt 100 and 150 miles to seaward all are towards the shore, the banks shoal so regularly and suddenly, and form such admirable guides to the mariner, who may track his way by the sounding line alone. On this duty Lieutenant Selby was employed betwixt the years 1849, 1850 and 1851. His survey extended from Diu, on the Kattiawar Coast, to Vingorla, or a longitudinal distance of 330 miles, his soundings covering an area of 40,000 square miles. The matter will be found discussed in one of the lectures given before the Society. Although not bearing very directly, perhaps, on the interests of navigation, few things would be more desirable than a sectional survey of the Arabian Sea from Bombay across to Aden, giving us deep sea soundings every half degree or so ; with a parallel set from Ceylon to Zanzibar. The method of accomplishing this resorted to in America so fully supplies our difficulties, that the work does not appear at all to exceed what the lesser vessels and younger Officers of the Indian Navy might accomplish in their leisure time.

Having thus concluded a cursory notice of Marine Surveys, the Review of Geographical enquiries in India would be incomplete without a short outline of one of the greatest geodistical operations recorded in history.

THE GREAT TRIGONOMETRICAL SURVEY IN INDIA.—The survey was recommended by the Marquis of Wellesley and his illustrious brother. It

* A survey of Viziadroog Harbour had been made by Lieutenant Domenichetti. An extract from his report was published, by order of Government, in June 1819, and is republished in the *Asiatic Journal* of the following year (1820, Vol IX. p. 123). I can find no other trace of his survey—his charts and diagram seems to have been lost. A memoir of a position of Captain Montriou's operations appears in our Journal for 1846, Vol VIII.

commenced in 1800 under the auspices of Colonel Lambton, of H. M.'s 33rd, who came out under the Duke in 1786, and was spared to preside over it for above twenty years. He was succeeded by Colonel Everest, who again was succeeded by Colonel Waugh, the present Surveyor General, so that in a work of extraordinary labour, and where those engaged in it must be exposed in an unusual degree to the injuries of the climate, three Officers, of rare industry and ability, have been spared for the long period of half a century to preside over a department in which change is singularly undesirable. The history of the instruments with which the survey was commenced is a curious one. The steel chain, the only measuring instrument available, had been made by Ramsden, on the pattern of that used by General Roy. It was sent out with Lord Macartney's expedition as a present to the Emperor of China, a more preposterous one could by no chance have been chosen. His celestial Majesty declined the gifts intended for him, and they appear to have been brought to Calcutta by Lord Mornington, and thence sent down to Madras, the only place in India where there is an Observatory. So soon as Seringapatam was taken and Mysore became ours, Lambton, whose talents had become known to the Duke of Wellington on the voyage out, submitted to him a plan for a survey, which was immediately recommended by Lord Clive, Governor of Madras, to the Governor-General. Every care having been taken to verify the chain, it appeared that the utmost reliance could be placed on its accuracy. It was made of blistered steel, and consisted of forty links of two and a half feet each, being thus a hundred feet in all. The other instruments were greatly out of order, but as well remarked by one of the most distinguished modern Mathematicians, no man can ever be a practical philosopher who cannot bore with a saw and saw with a gimlet. Lambton having little to choose from, and confident in his own unbounded resources, at once set about surmounting the difficulties with the means at his command. In selecting a locality for a base line, a surface as free of inequality as possible is always resorted to, but as it is impossible to obtain a perfect level where it is wanted, upright posts or pickets are driven into the ground, correct in equalities. The first base line measured by Colonel Lambton commenced in Lat. 12° 54′ 64″ N., near Bangalore, and extended 7° 43′ 21″ North-Easterly. For each length of his chain twelve strong pickets, three inches in diameter, hooped and shod with iron, were driven into the ground at intervals of about eight feet from each other, on the top of each picket was placed a piece of hard seasoned wood, eight inches in length and four in breadth, and over the whole a strong planking of wood six inches in width and four in depth, the whole being adjusted to the nicest possible level. On this the chain was lifted by twenty people, so as to avoid all strain, and laid down with all the microscopic precision that human skill and care permitted. The base line was commenced on the 14th November 1800, a red letter day in the annals of Indian Geodosy, and was completed in the extraordinarily short space of two months, the triangulation from its two extremities having been begun during the middle of December. The following year a magnificent set of instruments were sent out from home, consisting of a 36 inch theodolite, and 18 inch repeating theodolite, and a standard and brass scale by Cary. A 5 feet zenith sector and two steel chains by Ramsden, with miscellaneous instruments of lesser magnitude by various makers. The previous operations were considered rather tentative than permanent, and all the resources of science with the most perfect appliances the age allowed were now taxed for the main base,

which was laid down close by St. Thomas' Mount, Madras, on a nearly even plane, about 33 feet above the level of the sea. The work was conducted very much as before—it was commenced on the 10th of April and completed on the 22nd of May 1802. A second base line near Bangalore was in 1804 measured by Captain Warren, one of the Assistants of the survey. A fourth base was in March 1806 measured near Coimbatore, with a base of verification near Gooty, by the same plan as that resorted to at Bangalore, and when the first and last were brought in comparison by triangulation, the error committed in some five hundred miles of measurements, over a country of the greatest irregularity, was found to amount less than to four inches! Before the year 1815 the whole country, as far as Lat. 18, was covered with triangles, and by the time of Colonel Lambton's death, eight years afterwards, at the age of seventy-three, 165,342 square miles had been surveyed, at an expense of about nine and a half lakhs of Rupees, or about ten shillings a mile. In 1817 the Head Quarters of the Survey were transferred from Madras to Calcutta. Colonel Everest, who had for some time been assistant to Colonel Lambon, had, some time after his demise, been compelled from sickness to visit England. He returned to India in 1830, perfected in all the practical information of the day, and provided with the finest instruments that could be made. A base line was laid down very near Calcutta, the work having been completed in 1832, and others were shortly after finished at Seronje, at Bedur, and at Dehra Dhoon in the North-West Provinces before 1848. The length of the Dehra Dhoon base, as computed from that of Seronje at the distance of 430 miles, was six inches greater than made by actual measurement—there was in the Bedur base, at nearly a similar distance from Seronje, a difference of four inches betwixt the measued and computed lengths. Up to this date the grand total of area triangulated, amounted to 477,044 square miles, and the grand total of cost to Rupees 34,12,787, being at the average rate of 13s. 1d. per mile.

Scind Base Line.—The laying down of the Scind Base Line was in 1854 committed to the charge of Captain Tennant, of the Bengal Engineers. It extended from near Kurrachee northward, over the level surface of the Delta, over a distance of 7 miles and ¾. The utmost care had before been taken to verify the position of Kurrachee itself, and to ascertain the range and mean altitude of the tide; permanent Observatory having been established on purpose near the promontory called the Manora Point. The same instruments were employed and processes pursued on the present occasion as on the base line previously surveyed. The work was commenced on the 5th December 1853, and completed by the end of January, having occupied little more than seven weeks in all. The results arrived at were conclusive and satisfactory, and the party thereafter proceeded with the work of triangulation —through Scind, Kattiawar and Cutch.

# TRANSACTIONS

OF THE

# BOMBAY GEOGRAPHICAL SOCIETY.

## ART. I.—*Remarkable Hailstorms in India, from March* 1851 *to May* 1855. By DR. GEORGE BUIST.

THERE are few things in Meteorology so little understood, or so difficult to comprehend, as the formation in the air, and precipitation on the earth, of the drops or masses of frozen water termed hail; and nowhere so far as I know, that the phenomena of hailstorms manifest themselves in such frequency and magnificence as in India, or present such opportunities of studying the matter itself with such care and advantage.

Of the accounts of things of this sort, our newspapers afford almost the sole repositories; but it is seldom that any one keeps files of these for any considerable length of time; where it is otherwise, insects make fearful inroads on the sets that are kept, and dispersion is ultimately certain to overtake them on the death or the return to England of their proprietors. The Natives rarely read newspapers, and never keep them; and singularly enough, the publications which in India take the place of the annals of the time, seem neglected by our public libraries. Were it not so however, files unprovided with an index, speedily become so cumbrous and bulky as to defy consultation, in the lesser matters of their extracts, such as notices of the weather, and the like, and the masses of information they contain under these heads, of the utmost value to the naturalist, and the most perfect authenticity, speedily become lost irrecoverably; and yet is only by a collection of facts extending

over a series of years that we can ever hope to be enabled to generalise or to offer any theory or explanation of the mysteries we desire to have unfolded.

Reflecting on these matters, I resolved, in 1839, to prepare for publication in our Transactions a list of the more remarkable hailstorms that had occurred in India as far back as my information permitted; trusting to be enabled from time to time to continue, correct, or extend it, until I could hope to make some approach to the objects I had in view; and the most invaluable assistance was derived in this enquiry betwixt the years 1816 and 1842 from the *Asiatic Journal*—a publication discontinued thirteen years ago—the second part (about the half) of each volume of which was filled with most judicious selections of extracts from the newspapers—the whole work being so admirably indexed that anything contained in it, whether original or selected, might be come by with the utmost certainty, and almost without trouble. For the next ten years intervening betwixt 1841 and 1851, the newspapers required to be searched, and as this was a somewhat tiresome task, and one of considerable labour, it is not improbable that oversights may have occurred which would have been avoided had I picked out the extracts I desired as they appeared in print; and this since 1851 I have done unremittingly; so that if there be storms unchronicled, as I feel very certain there are many, especially in the year 1851 when hailstorms seem to have been in want of historiographers, the fault is none of mine.

The following will afford an outline of the conclusions I have for the present arrived at—I say for the present, for but few of them are fully established, and all stand in need of extension and elucidation:—

TIMES WHEN HAILSTORMS OCCUR.*—Hailstorms occur in India, so far

* The following, from Mrs. Somerville's Physical Geography, 1851, is remarkable for the number of its inaccuracies, considering the illustrious position of the authoress, and high character of the work:—

"Local circumstances, no doubt, have a great influence on its formation; it occurs more frequently in countries at a little distance from mountains than in those close to them or further off, and at all hours, but most frequently at the hottest time of the day, and rarely in the night. In the interior of Europe one half of the hailstorms take place in summer. Hail is very rare on the tropical plains, and often altogether unknown, though it frequently falls at heights of 1700 or 1800 feet above them, and at still greater elevations, in the Bolivian Andes

as appears from the published extracts, in the following proportions for the various months of the year :—

| | | | |
|---|---|---|---|
| January | 5 | July | 2 |
| February | 20 | August | 0 |
| March | 31 | September | 2 |
| April | 34 | October | 3 |
| May | 17 | November | 4 |
| June | 4 | December | 5 |

It will be seen that hail chiefly falls in our driest months,—February, March, and April—and does not seem dependent on temperature—May, which supplies seventeen hailstorms, being the hottest month of the year—the true maxima due to the season being masked by the rains wherever these occur near the summer solstice. December and January, almost the coldest months, are nearly devoid of hail. We have a few instances of hail occurring in June and July in Central India, when the rains were late in setting in, but the hailstones in those cases were always small, and the falls light in comparison to those experienced in other periods of the year.

HOURS WHEN HAILSTORMS OCCUR.—It very seldom happens that writers advert to the hours when hailstorms occur. Of a list of 30 published in a previous Number (IX. p. 196 for 1850), from the notes of that indefatigable observer Dr. Spilsbury, there are 10 set down as

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for example, above 12,000; and on the table-land of Ethiopia at heights between 6000 and 10,000 feet."

Our hail-storms are most abundant in the Delta of the Ganges, just under, or immediately beyond, many of them within the Tropics, and along the Coromandel Coast. Dr. Thomson, who published two years before Mrs Somerville, gives the following abstract of the seasons at which hail mostly falls—Mrs. Somerville's remark is confined to the continent of Europe:—

"This meteor rarely appears during the night, though Kamtz records several intances. Hailstorms most frequently occur at the hottest period of the day. In this country (England) they are most abundant in winter; the relative proportion being, in—

| | | |
|---|---|---|
| Winter, *to all the other seasons, as* | 45.5 | to 54.5 |
| Spring, | 29 5 | to 70.5 |
| Autumn, | 22.0 | to 78.0 |
| Summer, | 3.0 | to 97 0 |

In Germany and Switzerland the proportions are somewhat different, as Kamtz has shown from the records of the Meteorological Society of the Palatinate, where the seasons and hours of 440 hailstorms are noted. From that table we find that 194 occurred in spring, 122 in summer, 66 in autumn, and 58 in winter. During the same seasons, the number were greatest at 2 P. M., viz.—83, 15, 13, and 10; from 10 P. M. to 4 A. M both inclusive, we find only 18 hailstorms tabulated, of which, 8 occurred in summer, 5 in winter, 3 in autumn and 2 in spring. That hail falls among the lofty Alps, and even, as Balmat found, on the summit of Mont Blanc, is satisfactorily testified."

occurring at 3 or 4 P. M.; 1 at 4 P. M.; 4 at sunset; 5 at 11 A. M. or noon; 2 at 2 P. M.; 1 at 8 A. M.; and 1 at 9 A. M. Only 3 occur after dark, and none later than midnight.

PLACES FROM WHICH ACCOUNTS OF HAILSTORMS HAVE BEEN RECEIVED, *arranged Chronologically.*

Meerut, ....1761,1851,1855
Cawnpore, ...... 1817,1855
Mirzapore, ...... 1819,1852
Jubbulpore, 1821-23-24-25-27-31-36-37-39-40-41
Bangalore, ...... 1822,1851
Monghyr, .... .... .. 1823
Kamptee, ........1823,1831
Lahargong, .........1825
Bopalpore, ...... ....1825
Garth, ..............1825
Serampore, ....... 1827,1829
Tindolle, ..............1827
Kotah, ..............1827
Calcutta, ..............1829
Sylhet, ..............1830
Allahabad, .... .... ..1833
N. W. Mountains, 1827,1829
Nagpoor, .............. 1831
Raneegunge,............1834
Poona, ......1834,1847,1853
Benares, ........ ....1836
Secundrabad, .. ..1837,1851
Setapore,.............. 1838
Near Calcutta ..........1838
Saugor, .. ... 1838,1840,1847
Jessore, ...... .... ..1840
Mandavee,.. .. ..... ..1840
Sukkur,.... ..... .. ..1844
Sattara, ... .. 1845,1850,1852
Lahore, ...... ... 1847,1853
Simla, ....... 1847,1849,1853
Belgaum,........ 1847,1849
Bancoora, .. .... ... ..1847
Near Nassick, .........1848
Edulabad,..............1848
Broach, .... .... ....1849
Deesa,.............. 1849
Indore,............ ...1849
Jaulnah, ..............1849
Rhotas,..............1849
Tipperah,..............1849
Purneah,........... 1849,1852
Punjab,..............1849
Bhooloola, ............ 1849
Kurnool, .............. 1849
Peshawur,.........1849 1853
Dacca, ..............1[illegible]
Delhi,.. . ..1849,1851,1853
Banda, ..............1849
Gwalior, ..............1850
Rajpeepla,............1850,1851
Rajkota,... ........ .....1850
Rungpore,..............1851
Ootacamund,... ...... ..1852
Pondicherry,..............1852
Tirhoot, .............. 1852
Shahpoor (Punjaub)......1852
Kalabagh,..............1852
Landour, ..............1852
Sealkote,.............. 1852
Kurrachee, ... 1852,1853,1854
Mahableshwar,............1852
Hydrabad (Sinde) ...... 1852
Ceylon, ... ....... ...1852,1855
Ferozpore,...... ... ... ...1853
Nainee Tal,... ...... ......1854
Roorkee, ........ .........1854
Neemuch,..............1854
Jooneer, ....... ........ 1854
Poorundhur,..............1854
Aurungabad,..............1854
Bolarum, ..............1855
Hurryhur, ............ ..1855

PLACES WHERE HAILSTORMS HAVE OCCURRED IN INDIA, *arranged Alphabetically.*

Allahabad..................1833
Aurungabad.......... ......1854
Bancoora......... .........1847
Banda............. .........1849
Bangalore....... ...1822, 1851
Belgaum............1847, 1849
Benares......... .........1836
Bhooloola..............1849
Bolarum......... .........1855
Bopalpore... ... .........1825
Broach....................1849
Calcutta ....... ........1829
Cawnpore....... ...1817, 1855
Ceylon...... ... ...1852, 1855
Dacca......... ............1849
Deesa......... .........1849
Delhi.......1849, 1851, 1853
Edulabad..................1848
Ferozepoor..... .........1853
Garth........... ..........1825
Gwalior........ .. .....1850
Hurryhur...... .... ..1855
Hydrabad (Sinde).......1852
Indore.....................1849
Jaulnah....... ... .....1849
Jessore..................1840
Jooneer........... .. ...1854
Jubbulpore 1821-23-24-25-27-31-36-37-39-40-41
Kalabagh ..............1852
Kamptee.........1823, 1831
Kotah............. ....1827
Kurnool......... .....1849
Kurrachee..1852, 1853, 1854
Lahargong..... .......1825
Lahore...... .. ...1847, 1853
Landour.......... ....1852
Mahableshwur.. ......1852
Mandavee...... .......1840
Meerut... ...1761, 1851, 1855
Mirzapore.. ... ...1819, 1952
Monghyr....... ......1823
Nagpoor ............... 1831
Nainee Tal...... ......1854
Near Calcutta ...........1838
Near Nassick .........1848
Neemuch..... .. .......1854
N. W. Mountains 1827, 1829
Ootacamund... .. ..1852
Peshawur.. ... ..1849, 1853
Pondicherry.... .. ..1852
Poona.. ..1834, 1847, 1853
Poorundhur..........1854
Punjaub.... ..... ....1849
Purneah.........1849, 1852
Rajkote...... .. .....1850
Rajpeepla.. .. ...1850, 1851
Raneegunge.... .. ...1834
Rhotas..............1849
Roorkee..... .......1854
Rungpore.............1851
Sattara... ..1845, 1850, 1852
Saugor... ...1838, 1840, 1847
Sealkote........... ....1852
Shahpore (Punjab).. ..1852
Secunderabad.....1837, 1851
Seetapore..............1838
Serampore.... ...1827, 1829
Simla.......1847, 1849, 1853
Sukkur..............1844
Sylhet......... ........1830
Tindolle..... ........1827
Tipperah........ .......1849
Tirhoot...... ... .....1852

From the foregoing tables of localities where the hailstorms enumerated in my two lists have occurred, one very singular anomaly will become apparent—that whereas the Delta of the Ganges down to the sea in lat. 22°, and but little raised above the highest tide whose damp, tepid atmosphere contrasts as strikingly as possible with the pure crisp, vapourless air of the mountains, is the favourite locality of hailstorms, and whereas these are frequent along the western shore of the Bay of Bengal —from Surat south to Ceylon, in corresponding latitudes and altitudes on the Malabar Coast, hail is a thing nearly unknown, though appearing in abundance immediately to the north-westward, along the shores of Cutch and Sindh, and to the eastward, as at Sattara, Mahableshwur, in the Ghauts, and all over the Deccan, so soon as we get some 1,500 feet above the level of the Sea. The climate of the eastern side of India is in summer somewhat drier and hotter, as it is colder in winter, than along the Malabar Coast; but there is no such difference betwixt them as to explain, so far as appears, the absence of hail.*

In Europe and America, according to Dr. Thompson and Mrs. Somerville, hail rarely falls amongst, or very near the mountains: in India no such law obtains. In my present and previous lists will be found accounts of hailstorms in the central provinces of Ceylon, at Ootacamund on the Neilgherries, both 6000 feet above the sea, and in contiguity with mountain masses of much greater elevation,—Dodabetta in the latter case towering to the altitude of 8,500 feet—at Sattara and Mahableshwur, in the Western Ghauts, 1,700 and 4,500 feet respectively; at Simla, 8,000; at Nainee Tal, 6,000; and the Jummoo Highlands 1,500 above the sea—the last three in the bosom of the Himalayas.

It is by discovering and pointing out differences and anomalies often more than by tracing similarities and analogies, that we arrive at fact-

* In my previous paper, published in our Transactions, as well as in an abstract of it prepared by Colonel Sykes for the British Association, and given in their Reports for 1851, with some valuable emendations and additions of his own, it was stated that no hail fell on the sea level south of lat. 20°—it should have been added on the western shore of India—it seems not at all uncommon on the eastern shore: a hailstorm occurred at Pondicherry, south of Madras, in 1852, and various other places, if my memory serves me right, which I have not been able to catalogue. Trichinopoly, Masulipatam, and the Gossam Valley, some way from the shore but nearly on a level with the sea, are mentioned by Dr. P. Thomson, on the authority of Dr. Turnbull Christie, and Colonel Bowler.

In Europe, hailstorms usually travel rapidly over the country in straight narrow bands, of vast length, but very small lateral extension. On the 24th July 1818, a hailstorm passed over the Orkneys from S. W. to N. E., twenty miles in length and a mile and a half in breadth : it travelled at the rate of a mile in a minute and a half, or the speed of a race-horse ; ice covered the ground to the depth of nine inches, though the storm at no given place endured beyond as many minutes. * In 1788, a hail-storm moved directly from the S. W. of France to the shores of Holland. It marched along in two columns, the breadth of that on the west being ten miles, that of the east five miles, with twelve miles between them : the one extended nearly 500 miles, the other 440 miles ; the destruction occasioned by it amounted to close on a million sterling. †

The Indian hailstorm falls in very limited patches, and seldom lasts above fifteen or twenty minutes ; but the frequency with which hailstorms occur simultaneously at places remote from each other, but nearly in straight lines, seems to indicate a tendency on the part of the column to become continuous—probably they are at times more so than we imagine, only that such things are not made known to us where there are no Europeans, and where the country is thinly inhabited. The most noble of these are the hailstorms which fell on the 12th and 13th May 1853, at Ferozepore, Lahore, and Meean Meer, Peshawur, and Jummoo, places occupying a line 350 miles in length, right across the Punjaub: unluckily the ours at which they occurred at these places respectively are not given.

Although this is the only instance I am aware of, of a series of hailstorms bursting out simultaneously, and, if not quite forming a continuous line, appearing somewhat like a string of beads stretched across the country, we have numbers of them occurring in pairs or in threes on the same day at places remote from each other. Our first outbursts of hail nearly always happen within a week or two of each other at what may almost be termed the GLACIAL PERIODS of our climate, and I have no doubt that in many of these cases it would appear that there had been independent chains of hail showers, or of local atmospheric changes, many of which were accompanied by hail, had a greater abundance of records for reference

* Thomson, p. 175. † Ibid. 24,962,000 francs.

existed. The following examples of this will be founded in the printed list :—

| | | |
|---|---|---|
| Lohargong.. .. .. / Bhopalpore.. ... ... | 60 miles apart, 9th February 1825. | |
| Jaulna......... ...... / Aurungabad.. .. .. .. | 75 miles apart | 14th May 1849. |
| Deesa...... .. ... | 350 miles from latter. | |
| Kurnaul...... .. .. / Simla........ .. ... | 100 miles apart | 3rd May 1849. |
| Peshawur........... | 400 miles from Simla | |

Probably also at Dacca, where hail showers occurred almost daily during the first week of May.

| | |
|---|---|
| Ootacamund...... / Nursingpore..... | 50 miles apart, 20th March 1852. |
| Hydrabad, (Sinde). / Delhi.... .. .... | 500 miles apart, 17th April 1854. |

On the 16th, there was a severe hailstorm at Sattara, 700 miles south of Hydrabad ; but I have only coupled together those occurring on the same day.

It would occupy too much, both of our space and readers' time, to group up all the hailstorms into Glacial Periods.

It must not always be assumed that places are always prone to hail in proportion to the number of hailstorms assigned to them—the *apparent* excess or deficiency of these is not unfrequently to be ascribed to the care or negligence with which they have been recorded. The great seeming predominance of them at Jubbulpore, I attribute mainly to the residence for twenty years at that station of Dr. Spilsbury, an observer in all departments of natural history so faithful, patient, and minute, that the stations at which he has been quartered seem to abound more than others with matters of interest—that is, it is through his instrumentility we know much more about them than we were otherwise likely to have known. And so it is with many of our distinguished men who seem to "draw a line of light"* over whatever country they traverse.

In like manner, when we find hailstorms occurring forty times in twenty-six years, or on an average 1·65 times a-year, from 1820 to 1846, and then find that the years 1847, 1848, and 1849 afford us twenty, we must not ascribe the whole, or, perhaps, any part of this to change

* Humboldt's remark on Burn's Bokhara Travels.

of climate but to improved registration. On the other hand, again, when we find 1849 affording us fifteen storms, or above three times the number of any of the years around, when there is no reason why there should have been any change in respect of registry, we may fairly set this year down as having been peculiarly favoured in its falls of hail. As already stated, it was not till 1847, that I began to carry out this process of scissors and paste registration—the seven and a half years it has been in practice give accounts of above sixty hailstorms, or an average of nine annually.

If, in reference to the season of the year when, the localities where hail-storms occur, as well as the frequency of their occurrence on an average of years, very great uncertainty prevails, there is a large number of facts formerly ignored, discredited, or classed amongst the catalogue of possibilities that have never been fully verified, of which we are only beginning to avail ourselves; and instead of having to deal with the most vague and uncertain statements as to blocks of ice the size of elephants, or hailstones as large as oranges, potatoes, pumpkins, or pullets' eggs, we have now, in the midst of a heap of descriptions of this sort, a sufficient number to render those intelligible of accounts where feet and inches, pounds, ounces and grains, as determined by trustworthy and competent observers, are supplied.

There are four occasions on which remarkable masses of ice, of many hundred pounds in weight, are believed to have fallen in India. (Dr. Thomson records dozens of such in all parts of Europe.) One near Seringapatam, in the end of last century, said to have been the size of an elephant. It took three days to melt. We have no further particulars, but there is no reason whatever for our doubting the fact.

In 1826, a mass of ice nearly a cubic yard in size, fell in Khandeish.

In April 1838, a mass of hailstones, 20 feet in its larger diameter, fell at Dharwar.

On the 22nd of May, after a violent hailstorm, 80 miles south of Bangalore, an immense block of ice, consisting of hailstones cemented together, was found in a dry well.

These masses of ice, like many of those considered hailstones of the largest size, have, in all probability, been formed by violent whirlwinds or eddies, and seem to have reached the monstrous dimensions in which we find them,

either on their approach to or their impingement on the ground; and the same thing will apply to those of much more moderate bulk, and which are commonly considered hailstones, though, when examined, they turn out to be a number of these aggregated together. Many of the masses doubtless owe their origin to being swept, like that of 1852 near Belgaum, into hollows or cavities—in this particular case into a dry well—where they become almost immediately congealed into a mass.

The following abstract is from the paper already referred to, prepared by Colonel Sykes for the British Association of 1850 :—

" On the 10th of April 1822, at Bangalore, a hailstorm killed many cattle, the hailstones being represented by the natives as large as pumpkins. *Three days after the storm* the gentleman who gives an account of it says, ' I went to the spot and found the carcases of 27 bullocks lacerated by hailstones; also dead birds. In a tank 800 yards in circumference, half of the surface was covered with floating masses of hailstones which had been carried down the ravines two days before; some of the masses were five and a half inches in thickness; the hailstones were angular and oval, and some measured three inches in diameter.* '

At Kamptee, on the 3rd of June 1823, an officer writes, ' the hailstones, without exaggeration, were as large as pullets' eggs'.

At Bopalpoor on the 9th of February 1825, an officer writes, ' the hailstones were the largest and most extraordinary ever seen, some of them being larger and as heavy as goose-eggs, which they resembled.'

At Serampoor in Bengal, on the 30th of March 1827, the European writer says, ' each of the hailstones was equal to the size of a goose's egg'.

At Kotah, on the 5th of March 1827, the hailstones were as large as a man's fist, and the next day remained unmelted, of the size of pigeons' eggs. Men, animals, and birds were killed; in the village of Nauda alone six persons were killed and seven others dangerously bruised.

At Calcutta, on the 20th of April 1829, the Editor of the *Bengal Chronicle* says, ' one of the hailstones brought to us was larger than a duck's egg:' many of them were angular fragments of ice, and several natives were killed.

At Serampore the hailstones were as large as hens' egg, and consisted of coats like an onion; the nucleus was whiter than the exterior.

At Sylhet, on the 19th of February 1830, the hailstones were the size of the largest potatoes.† Sheep and goats were killed. At Jubbulpoor, on the 9th of April 1831, the hailstones were the size of guinea-fowls' eggs. On the 10th of April 1831, at Kamptee, some of the hailstones measured from ten to twelve inches in circumference, few or none smaller than a hen's egg; five persons were killed in the neigbourhood. At Allahabad, on the 5th May 1833, a hailstone weighed 6¾ ounces troy, and measured ten inches in circumference. At Chunar, on the same day, the gentleman writes, ' blocks of ice fell; I am really speaking within bounds when I say a goose's egg was a trifle compared to some of the stones that fell; one measured 11½ inches in circumference.' ' I am informed' he adds, ' one hailstone in the bazaar weighed *two pounds*.' On the 16th of March 1834, at Raneegunge, a gentleman travelling in a palkee writes, ' my palkee top yesterday was broke through in three places by hailstones, and one of my

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* This was on the third day after the fall in the scorching month of April.

† Potatoes in general are not much larger than hens' eggs in India.

bearers knocked down by them.' At Pubna on the 12th of April 1834, one of the hailstones measured a foot in circumference, and another weighed eleven ounces. At Benares, in February 1836, some of the masses of ice weighed two pounds. At Secunderabad, on the 30th of March 1837, some of the hailstones were two inches in diameter. At Dum Dum, the artillery cantonment in Bengal, on the 8th of April 1838, two hailstones were picked up which measured sixteen inches in circumference, and better than five inches in diameter. At Jaulna, on the 14th of January 1849, the hailstones were as large as billiard-balls. On the 5th of February 1850, at Gwalior, pieces of ice fell nearly two pounds weight, and animals and some men were killed. At Condwiel, near Sattarah, on the 7th of April 1850, some hailstones were as large as cocoa-nuts; the writer says, 'I am within the mark when I say they were as large as cocoa-nuts.'

To the above Dr. Buist adds Dr. Spilsbury's personal notes of hailstorms consisting of thirty instances. He speaks of goats and sheep being killed, and on one occasion of hailstones being as large as hens' eggs, and he mentions the unexampled fact of a hailstorm in *July* in the midst of the monsoon. The above notices afford ample and unimpeachable testimony to the extraordinary magnitude of the masses of ice that fall in India in hailstorms. Colonel Sykes adds, that in a paper in the Philosophical Transactions for 1835, he had spoken of the fall of masses of clear ice exceeding an inch in diameter in hailstorms; and on one occasion globular masses of clear ice fell inclosing a central star of many points of diaphanous ice like ground glass of which he made drawings. Colonel Sykes suggested that the operations of nature producing such instantaneous and intense cold in the atmosphere, whether by electrical or other causes, and the singular aggregation of the drops of rain or particles of the water to constitute masses of ice in the air, had not received that attention from physicists which the remarkable character of the phænomena seemed to demand."

Since then two hailstorms of much greater magnitude, and more disastrous consequences, have occurred than any here made mention of, that in the Himalayas north of Peshawur on the 12th May 1853, when 84 human beings and 3000 oxen were killed, and that which occurred at Nainee Tal, a Sanitarium on the lower Himalayas, on the 11th May 1855. Of the Peshawur storm we have few details beyond the fact that the ice masses were very hard, compact, and spherical, many of them measuring 3½ inches in diameter, or nearly a foot in circumference; and this fact seems to have been given from measurement, not by guess.

The description of the Nainee Tal storm, from the pen of an eye-witness of intelligence and information, is the best we possess. The approach of the storm was heralded in by a noise as if thousands of bags of walnuts were being emptied in the air. At first the hail was of comparatively small size about that of pigeons' eggs; it gradually increased in magnitude, till it reached the dimensions of cricket balls. Pieces, picked up at all parts of the station, were carefully weighed and measured, and the results will be found further on.

In the unhappy ignorance of the science of meteorology now prevail-

ing around us,* it seems generally supposed that these hailstorms are peculiar to India; and many educated persons who have lived long in the country are disposed to receive such narratives as those of the Peshawur and Nainee Tal ice-storms as fabulous, or grossly exaggerated. To correct errors of this sort, and if possible encourage observation, I may, I trust, be pardoned for introducing the following quotation from Dr. Purdie Thomson's meteorology, published in 1849, the year before the first collection of Indian hailstorms was laid before the world. He falls into the error of believing them nearly unknown between the Tropics:—

"The following are examples of remarkable hailstones. In Scripture we are told that hailstones were miraculously showered down upon the Canaanites, during the memorable combat of Joshua with the five kings of the Amorites. Need we remind the reader of the plague of hail with which the Egyptians were afflicted?—when 'there was hail, and fire mingled with the hail, very grievous, such as there was none like it in all the land of Egypt since it became a nation,'—when the terror-stricken Pharaoh cried, 'it is enough, entreat the Lord that there be no more mighty thunderings and hail.' Miraculous as was this destructive and appalling manifestation of Divine power, it is interesting to observe that the laws of nature were not infringed,—it was electrical. Tibullus mentions the fall of ponderous stones, supposed by Silvius to have been large hailstones. Holinshed records that hailstones as large as eggs fell in England in the year 1202, during the reign of John; and that in the 20th year of that of good King Alexander III. of Scotland (1269), there rose 'great winds, with storms of such *unmeasurable* hailstones, that manie townes were thrown down' by their violence, and fires spread throughout the kingdom, 'burning up steeples with such force of fire that the belles were in diverse places melted:' those of the Abbey of Aberbrothwick were thus destroyed. In 1339, while Edward III. was marching near to Chartres in France, his army was so much injured by a storm of immense hailstones, that he conculded peace. In 1510, when Louis XII. of France made war against the Pope, and carried his army into Italy, during a thunder-storm bluish hailstones fell, weighing about 100 pounds. On June 21, 1545, there fell in Lancashire 'hailstones as big as men's fists, which had diverse prints in them, some like gun-holes.' On the 7th June 1573, hailstones 6 inches in circumference fell in Northamptonshire. On April 29, 1697, a storm passed over Chesshire and Lancashire, which had arisen in Wales. Its course was two miles broad and sixty long; hailstones weighing 8 oz. and measuring 9 inches in circumference, were gathered. On the 4th May, in the same year, a shower of hail fell in Hertfordshire after a thunder-storm, the hailstones measuring 14 inches in circumference, and killing several persons. On May 15, 1703, hail fell at La Perche, as large as an egg,—Parent. Large hailstones fell on June 7, 1711, at Rotherham in York-

* It is, perhaps, needless to remark, that nearly all the notices published below have appeared in the *Bombay Times*. On the appearance of that from Chicknaikunhully, to which the writer subscribes his name, the conductor of an English daily journal clearly considered the whole a hoax and an impossibility, and for several weeks or months on end it seemed to be considered the rarest possible joke to speak of the Editor of the *Bombay Times*, as Dr. Chicknaikunhully—while matters of this sort furnish criteria for the truth of what is advanced in the text—where the most commonplace facts in natural history are deemed incredible, and a nickname bestowed on him who promulgates them passes for wit, but little can be said of the state of education even amongst "the best possible public instructors," as little for that amongst the pupils.

shire ; and at Toul, on the 13th July 1753, at 6 P. M., of a similar size,—Montignot and Tressan. At Utrecht, in 1736, they fell in size like pigeons' eggs.—Musschenbrock ; and in 1768, at Paris, of great magnitude. In 1784, hail fell among the Pyrenees, weighing 23 ounces. On 5th June 1784, about 2 P. M., at Selborne, hail was found measuring 3 inches in circumference ; the air was strongly electric, and rain fell in such a torrent as to move stones weighing 2 cwts ; the storm extended two miles in length and one in breadth On August 19, 1787, at midnight, hail weighing 9 oz. fell by the Lake Como,—Volta. On the 4th May 1797, in Hertfordshire, one was seen measuring 14 inches in circumference. A mass of ice of enormous magnitude fell in 1803 in Hungary. Hail as large as walnuts fell on the 8th February 1801, upon the British fleet in Marmorice Bay, in Asiatic Turkey. Masses of ice, having a perimeter of 8 to 9 inches, fell on the 15th July 1808 in Gloucestershire,—Howard. A hailstone, measuring 6.5 inches in diameter and cuboidal, fell near to Birmingham on the 8th June 1811 ; it resembled a congeries of masses about the size of pigeons' eggs, agglutinated together. The same year, Muncke weighed hailstones of 4 oz. troy, collected in Hanover. In August 1813, hailstones like eggs fell upon the British army in the pass of Maya in the Pyrenees ; the storm lasted twenty minutes, but was not accompanied by lightning or thunder. On June 4, 1814, hail from 13 to 15 inches diameter fell in Ohio. In the summer of 1815, during a thunder-storm at Malvern in Worcestershire, hailstones fell as large as walnuts, and in some places to the depth of several inches. In the Orkney Islands, on the 24th July 1818, during thunder, a very remarkable shower took place ; on that occasion they were gathered as large as a goose-egg, mixed with large masses of ice. M. Delcross mentions that spherical hailstones, measuring 15 inches in circumference, fell at Baçonniere on the 4th of July 1819. Matteucci mentions a hailstorm which overthrew walls, destroyed trees, and wounded cattle ; some of the hailstones weighed one pound and a half, one as much as 14 pounds, and another forced the roof of the house upon which it fell. In May 1821, they were met with of great size at Palestrina in the Roman States. On the 7th of May 1822, hailstones fell at Bonn, 1.5 inches diameter, weighing 300 grains ; men and animals were killed by them, Nöggerath mentions that the masses had a concentric structure around an opaque white nucleus, the layers increasing in translucency as they approached the external surface ; they had a fine stellular fibrous arrangement from rows of radiating air-vesicles. On the 9th of August 1828, pieces of ice, some of which measured 3 inches long and 1 broad, fell at Horsley, Staffordshire. On June 5, 1829, hailstones and large masses of ice fell at Cazorta in Spain, the largest pieces weighing above four pounds. On October 5, 1831, masses as large as a goose-egg fell at Constantinople. On May 8, 1832, an immense mass of aggregated hailstones fell in Hungary, which measured about a yard in length, and nearly two-thirds of that in depth ; the same year, on August 13, very large hail fell on the Nile, weighing from 3 to 16 troy ounces. In June 1835, hail measuring fully 8 inches in circumference, fell from a dense cloud during a thunder-storm near to Edinburgh : they were bluish, elongated, and when broken presented a conglomerated appearance ; they fell about 18 inches apart. On August 1, 1846, during one of the most appalling thunder-storms on record, hail weighing from 1 oz. to 2 oz. avoird. fell in London, destroying a vast amount of property,—Buckingham Palace, Westminster Hall, and numerous other buildings were much injured ; the loss sustained by gardeners alone, was estimated at £15,000. During a terrific thunder-storm on the 4th of February 1847, in New South Wales, hailstones of enormous magnitude fell abundantly ; they were from the size of an egg to that of an orange, and measured 14 inches round ; the forms were very varied. On the 26th May in the same year, very large hailstones fell at Berlin ; and on the 18th July, at Leipsic, killing many of the feathered tribe."

FORM.—The forms of the hailstones which fall in India seem pretty much the same as those that have been examined at home, and they are chiefly of four kinds—1, pure crystalline masses, either globular or lenticular, internally transparent, but covered externally with a coating of opaque white ice; 2, the same, but with a star of many points in the centre, the principal rays of which extend to the circumference—the section being singularly beautiful; 3, nearly globular, consisting of thin concentric layers, like the coatings of an onion, of different degrees of transparency, as if increased in size by film after film being frozen over them in their descent; and 4, agglutinated masses of hailstones, cemented together subsequent to their primary formation—if indeed these last, which may consist in part of any of the previous three varieties, are entitled to the name of hailstones at all.

SIZE.—I have already stated that we are now no longer required to refer, unless for the sake of familiar comparison, to our hail being as large as pigeon, pullet, or goose eggs, or pumpkins, having abundance of accounts to quote from where it has been correctly weighed and measured, and its precise dimensions put on record. The largest hailstones seems to be from ten to thirteen inches, and to weigh from nine to eighteen ounces. But these are the extreme exceptional cases; and our average maxima appear to be from eight to ten inches in circumference, and from two to four ounces in weight. Their forms are so seldom regular that it is rarely possible to deduce the one fact from the other.

It is not every one who has the promptitude of the describer of the Nainee Tal storm; but were any one, when a hailstorm occurs, to pick up two or three of the largest pieces, taking care to note the number, and if not provided with a balance of his own, to send the water they have yielded to the Apothecary of the station to be weighed or measured, forwarding a note of the result, the cubical contents of the mass might be easily computed, and much valuable information obtained. From the weight of the water it yielded, one of the most important facts connected with it becomes determined, its mass. The fracture of the hailstones when large, with the view to examining, and if possible, sketching their internal substance, is what should be resorted to as frequently as possible, India affording much greater facilities in this respect than can be looked for elsewhere.

No hailstones have ever been known to fall in India to be compared in magnitude to very many of those enumerated at the close of the quotation given in a previous page; nor are our much vaunted blocks of ice the size of some which seem to have filled Dr. Thomson with incredulity, of anything like equal in size to at least a dozen described by the writer himself as having fallen in Europe. The great distinguishing characteristic of the Indian, as contrasted with the European hailstorm, is, that with us in the great majority of cases the hail which falls exceeds the size of filberts, at home it seldom amounts to that of peas or beans; that which here is the rule, occurring many times every year, is in Europe the exception—not, happening, oftener than once in ten or twenty years. At home there is, perhaps, scarcely a hailstorm of note that has occurred within the past five hundred years, a description of which may not be found in print: we have in India no records of any natural phenomena whatever above a century old: Native historians while they chronicle with the most painful minuteness the births, marriages, and deaths, and all the most trivial incidents in the families of their chiefs, passing over in silence the devastations of floods, earthquakes, and volcanoes, and all the more terrible and destructive phenomena of nature; and that anything so trivial as a hailstorm should be noticed by them is not to be for a moment imagined. It is little more than seventy years (1778) since printing made its appearance in India; and with the press our first attempts to collect local information began—yet I question if up to within the last ten or twenty years we have anywhere on record accounts of half the most destructive hailstorms or other similarly marvellous things that have occurred within our dominions.

1.—HAILSTORM AT SECUNDERABAD ON THE 11TH MARCH 1851.—Lat. 17·30 N.; Long. 78·20 E. Alt. 1837.

A correspondent at Secunderabad writes as follows, under date 5th April:—"On the 2nd March we had a slight shower of hail, and on the 11th of last month there was a very severe fall of hail, about four miles from this. The sky now looks very threatening,—large masses of dark clouds hanging about."

2.—HAILSTORM AT MEERUT ON THE 28TH MARCH, 1851.—LAT. 29·0 N., LONG. 77·45 E.

The subjoined account of a violent hailstorm at Meerut on the 28th March is from the *Mofussilite* of the 1st April:—"On Friday last Meerut was visited by a hailstorm of unusual violence. The hailstones were considerably larger than pigeons' eggs, the usual standard of measurement on such occasions. We regret to hear that much damage was done in the gardens and fields of the station and district. The prospects of the ensuing fruit season are now reduced to a possibility, and the splendid crops are said to have suffered very severely.

3.—HAILSTORM AT DELHI ON THE 19TH APRIL 1851.—LAT. 29·31 N., LONG. 77·13 E.

A severe hailstorm visited the Delhi district on Thursday, too late, fortunately, to do any injury to the crops. The hailstones, which continued to fall for more than half an hour,

were of large size, and must have done extensive damage, had any of the grain been left standing. At present the atmosphere is charged with electricity, and we may expect a few more thunderbursts before the weather become settled.—*Delhi Gazette.*

4.—HAILSTORMS AT RUNGPORE ON THE 22ND APRIL 1851.—Lat. 25·42 N., Long. 89·14 E.

The subjoined account of a terrific hailstorm at Rungpore is taken from the *Englishman* of the 2nd May: the hailstones are described as being equal in size to ducks' eggs!—"A correspondent at Rungpore says:—'Have you heard of the dreadful hailstorm we had here on the 22nd of this month? (April.) It was one of the most terrific ever known in these parts. It destroyed hundreds of houses, and no small number of trees. Some old ones which had stood the storms of a hundred years came down. All the fruit in the gardens is destroyed. The hailstones were as large as ducks' eggs, and the whole station looks like a wreck.'"

5.—HAILSTORM NEAR BANGALORE AT CHICKANALLENHULLY, ON THE 22ND MAY, 1851—Lat 12·57, Long. 77·38

FALL OF ICE NEAR BANGALORE.—We have been favoured by Mr. R. S. Dobbs, Madras C. S., with the following account of an extraordinary fall of hailstones and blocks of ice, which occurred on the 22nd May at a place eighty miles from Bangalore,—for which we beg to return him our sincere thanks:—

TO THE EDITOR OF THE BOMBAY TIMES.

SIR,—Having received an official report from the Amildar of Chickanallenhully of an extraordinary fall of hailstones, which appeared to me hardly credible, I had the circumstances enquired into by a Punchayet, and have now much pleasure in communicating the particulars as attested by many respectable Natives, for any observations to which they may be considered entitled by yourself and the scientific portion of the Bombay community.

On the evening of the 22nd May, at Chickanallenhully, eighty miles South-west of Bangalore, and forty miles west of Toomcoor, there was a heavy fall of rain, accompanied, after the night closed in, by thunder, lightning, and hail. The hailstones were for the most part about the size of oranges and limes, which broke the tiles on the roofs of houses, and seriously injured cocoanut and beetle-nut gardens, and many fruit trees, crushing many young trees, and breaking down a few larger ones, but neither men or beasts were injured, all having sought shelter at the commencement of the rain. The next morning many hailstones as large as pumpkins and jack fruit were found on the plain, extending three miles south of the town; and one immense block, measuring four and a half feet in length, three feet in breadth, and eighteen inches in thickness, was found in a dry well.

Believe me, yours faithfully, R. S. DOBBS.

*Toomcoor, 5th June*, 1851.

6.—HAILSTORM AT OOMREE, 7 MILES WEST OF REWAH, ON THE 7TH FEBRUARY 1852—Lat. 73·30 Long. 23·10

Since my list of hailstorms, I have only had to record one under my own observation, and which occurred about 3 P. M. at a place called Oomree, seven miles west of Rewah, on the 7th Feb. last, the hailstones fully as big as pigeons' eggs. It did not last long, but was very violent, and tore my tent sadly. This village, Oomree, must have been about the centre, as it did not extend to Rewah E, and only about four miles to the westward, as my camels were about that distance, and had only rain.—*Delhi Gazette.*

7.—HAILSTORM AT KANDY (CEYLON) ON THE 15TH MARCH 1852.—Lat. 7.17 N., Long. 80.36 E.

"KANDY, (CEYLON) 15TH MARCH.—In our last issue we alluded to a fall of hail in Kandy; since then we have been favoured with the following communication on the subject—"On Monday (15th) afternoon, at a sudden the Town assumed a dismal appearance, and heavy showers of rain commenced to fall, accompanied by peals of thunder. The wind blew with such irresistible fury that the branches of some trees towards the Lake road were broken down to the ground. There was also a fall of hail for nearly an hour, and so much was the curiosity it excited that crowds of persons were seen in spite of the rain, busily engaged in picking up the stones; which were as large as bullets. After a few hours, the rain ceased, thick clouds that were overspreading the country disappeared, and a fine calm and clear evening followed. The night was quite obscure, and the atmosphere very humid—a star was scarcely to be seen in the firmament—and lightning was flashing from every quarter, illuminating the country, and making the smallest object visible. What those sudden vicissitudes are owing to, is what we are at a loss to define."

8.—HAILSTORM AT OOTACAMUND ON THE 19TH MARCH, 1852.—Lat. 11·50 N., Long. 76.45 E. Alt. 7,300.

OOTACAMUND, 19TH MARCH.—A hailstorm a few weeks before—no particulars.

I beg to inform you that a very severe hailstorm occurred at Ootacamund at 2 P. M. on the 19th March. The hailstones were not large, but sufficiently so to do considerable damage in the gardens. It lasted abort an hour, when the ground was as white as if snow had fallen: buckets full, caught from the house-tops, were next morning large lumps of ice,—but as this is an article little cared for in this cold region no one took the trouble to keep it. Since this occurred, the weather has been much colder, and we cannot as yet throw off any of our winter clothing or blankets.

9.—HAILSTORM AT NURSINGPORE, ON THE 19TH AND 20TH MARCH 1852.—Lat. 22 56 N., Long. 79 18 E. Alt. 1000.

A letter of the 30th March, from Nursingpore, contains the following items:—"In my last of the 13th April I mentioned that the weather was extremely sultry, hazy, and suspicious; and I have now to communicate that, from the 17th to the 27th, we experienced a stormy period of greater intensity and duration than is usually encountered inland upon the sun's equinoctial passage. Rain, more or less, fell on each day, attended invariably with much lightning and thunder, and occasionally with violent gusts of wind. On the 19th at 2-50 P. M., a fall of hail of the size of ordinary grapes occurred, with lightning and loud bursts of thunder; and on the following day, at 2.10 P. M., a similar phenomenon took place during bright sunshine. No cloud, in this instance, was to be discerned whence the hail proceeded. In the London *Athenæum* of the 22nd November last, Mr. Radcliff Birt alludes to the absence of any cloud during a fall of snow he witnessed, and offers some interesting explanatory remarks on the peculiarity: and the matter is further elucidated by Mr. W. Gladstone in the same publication of the 6th December. No lightning or thunder accompanied this last fall of hail here, and the only body of cloud was at an altitude of about 40° in the southwest quarter. The zenith was quite clear. The total fall of rain amounted to inches 1.337 during the above days. The weather is now fine, cloudless and agreeable. Stormy boisterous weather has been prevalent for the past ten or twelve days all around us, and the dawks in consequence somewhat impeded.

10.—HAILSTORM AT PONDICHERRY, ON THE 24TH MARCH 1852.—Lat. 11·57 N., Long. 79·54 E. Alt. 20.

PONDICHERRY, 24TH MARCH.—Pondicherry was visited by a hailstorm between 3 and 4 in the afternoon of Wednesday last (24th) during a squall from the north east. The hailstones which fell in large quantities for about 15 minutes, were generally formed of a transparent covering over a white but opaque interior, and most of them were flattened or armed with points. The largest might have been an inch and a half in diameter. Pondicherry, says *Le Moniteur Official* has never been so visited before in the memory of man. Surely this meteorological phenomenon, as our cotemporary styles it, must portend some momentous event to the Colony! We really though never remember hearing of a hailstorm at Madras, but hail fell at Rajah's Choultry in 1845 in large quantities.—*Madras United Service Gazette, March* 30.

11.—HAILSTORM AT PURNEAH ON THE 25TH MARCH, 1852.—Lat. 25·48 N., Long. 87·33 E. Alt. 30.

A Correspondent at Purneah says:—"I never see any letters from this district in your papers about rain, sun, hail, storms, indigo prospects, &c., which induces me to turn scribbler myself, and stir up those around me who wish to be enlightened. It is nearly eight months now since we have had any rain in this district. It was in every one's mouth that 'I have never seen such a very dry year,' 'I have never seen so few norwesters.' Every planter was looking rather low as to his prospect. Thousands of beegahs yet to be sown, and no moisture to sow with, nor any sign of clouds that was likely to cheer our hearts. I for one was with some others concocting some plan by which we could hermetically seal and preserve our seed for next year, which at all events would have saved us the expense of buying fresh supplies, when on the 19th and 21st instant we had two most beautiful showers of rain. To horse the next morning, to see how far the rain had extended, which to my entire satisfaction every field had had its share. All was going on splendidly, when last night the flood gates of heaven seemed to have opened, for there came such a down-pour *as I never did see*, accompanied with *hail* too. The rain was ushered in with a tremendous thunder-storm from the northwest, then came the hail, as big as pigeon's eggs, sending all the young plant back again into the ground as fast as it had come out. The hail lasted a quarter of an hour, and then followed the rain

which lasted all night (as heavily as it could come down) up to this evening. Fancy my disgust this afternoon in taking a ride on my elephant, to see how matters stood, to find nearly all my low lands with about knee-deep water over them, and all my high lands, that I had lately sown, of which the plants had just came up, all spoilt with the nasty hail. I forgot to mention in the proper part of this letter *all* the damage the hail did, for it was not confined to my Indigo alone, but touched up the little birds on the trees, a number of which I found dead on the ground. It has also killed a number of cattle belonging to the poor ryots, who had no sheds for them.

I have never seen such heavy rain in this month any time before. The country looks quite inundated. It will do some good to the paddy cultivation, and that's the only good I believe it will do. Indigo, I fear, is up the spout this year, if this rain has been general, which I have not the slightest doubt it has been. The weather is delightful, and we have not yet left off coverings at night. A fire during the two days it rained was anything but disagreeable.

12.—HAILSTORM AT TIRHOOT ON THE 26TH MARCH, 1852.—Lat. 26·7 N., Long. 85·26 E.

We were visited on the 26th March, with one of the most terrific hailstorms I have ever seen; it continued until sun-set, the ice lying six inches deep on the ground when it subsided. Numbers of cattle have been destroyed, and birds were strewn about in all directions; some human lives were lost. Of course every tree was stripped; and the young Indigo plant destroyed. The country looks a total wreck. All the next day hailstones were picked up, some of them the size of a pigeon's egg. During the storm pieces of ice were observed to fall large enough to fill the mouth of a tumbler; they were flattened, and irregular in shape, as if several hailstones had clustered together during their descent.

13.—HAILSTORM TO THE NORTH OF SHAPOOR, (PUNJAUB) Lat. 32·8 N., Long. 72·15 E.

KALABAGH Lat. 32·57 N., Long. 71·37 E., and MAREE, Lat. 32·57 N., Long. 71·41 E.

We are in receipt of letters from various parts of the Punjaub, and with the exception of a few petty disturbances noticed elsewhere, all seems quiet. From Leia we learn that refreshing showers have fallen every second day, and the crops promise a most abundant harvest; grain is selling at very cheap rates,—Wheat one maund and fifteen, to one maund and twenty seers per rupee; Gram one maund and ten, to one maund and fifteen seers; Barley two maunds and ten seers; Bajree one maund and thirty seers; Goor fourteen, fifteen and sixteen seers, and Salt sixteen seers per rupee.

There has been a disastrous hailstorm to the north of Shahpoor, which has destroyed a great portion of the crops, and killed a very large number of cattle. The hail has also done considerable damage in the neighbourhood of Kalabagh and Magee; one correspondent states that the hailstones were as large as pigeons' eggs, and that it fell "in maunds."

14.—HAILSTORM AT LANDOUR ON THE 1ST APRIL 1852.—Lat. Long.

LANDOUR, 1ST APRIL,—Notwithstanding the advanced season, we continue to have most uncongenial weather—rain, rain, constant rain. As I am writing, (11 A. M.) 'tis blowing a hurricane. Last night, at half-past eight o'clock, we experienced a smart shock of an earthquake, lasting fully 30 seconds. During that time it was really alarming—one continued vibration—windows shook, doors creaked, and it became so bad at last that my wife and I, each took up one of our children, and made a rush outside, fully expecting the house would come down! Immediately following *we had a violent storm of hail, accompanied with thunder and lightning, and this continued the whole night.* During the storm of the 22nd, the electric fluid struck a house at Mussooree near the Brewery, driving the window frame inwards—some cattle, which had taken shelter in the veranda, were killed.—*Lahor Chronicle, April 7.*

15—HAILSTORM AT SEEALKOTE (PUNJAB) ON THE 2ND APRIL 1852.—Lat. 32·35 N. Long. 74 20 E. Alt. 1,100.

A letter from Seealkote, dated 3rd of April, says:—"We had a tremendous hailstorm last night. I never saw anything like it before. The ground was covered, and many heaps of hail remained till the sun was long up this morning. We have had too much rain now, and I am sure those who are building, sincerely hope it may cease. Fine weather to-day.

Another letter, dated Wuzeerabad, 1st April, says :—"The evening before last we had a heavy fall of rain, accompanied with terrific thunder and lightning. The roads are so entirely flooded as to be next to impassable."

16.—HAILSTORM AT GHISREE BUNDER (SINDE) ON THE 5TH APRIL 1852.—Lat. 24·48 N., Long. 67·8 E.

A correspondent writing on the 5th from Ghisree Bunder, tells us that on that day the country had been visited by a storm of thunder and lightning, accompanied by heavy rain. The thunder was audible in the morning at 8 o'clock; when a storm seemed blowing in the west and north-west. The rain commenced about 1.30 P. M., and between that time and 2. P. M., a heavy shower of hail fell,—many of the hailstones being ¾ of an inch in diameter. The wind during the storm was north and northerly, at one time verging to the east; but at no time violent.

17.—HAILSTORM AT KURRACHEE ON THE 5TH APRIL 1852.—Lat. 24·51. N., Long. 67·2 E. Alt. 10.

KURRACHEE, April 5.—Preceded by loud peals of thunder on Monday last, we had a heavy fall of rain, which commenced a little before midday; through the thickening of the atmosphere and the gathering of dense masses of clouds commenced showing themselves from the north about 11 A. M. and for a short time entirely obscured the sun's rays—which caused an intensely sultry heat that lasted till the shower cooled it—it rained heavily for an hour, and then cleared off, both rain and thunder veering away to the southward. We have been assured by residents of the town that the rain was much heavier there than in Camp, and that largely congealed particles fell—not like ordinary hailstones but irregularly formed pieces of ice; this we can believe, as at one time the rain was accompanied by a very chilling breeze.—*Sindian.*

18.—HAILSTORM AT MAHABLESHWUR ON THE 16TH APRIL 1852.—Lat. 17.56 N., Long. 73.30 E. Alt. 4,500.

On Friday last, the 16th April, the weather had become perfectly oppressive in the forenoon, preceded some few days by great piles of thunder clouds to N. N. E. About 2 o'clock, the sky became suddenly overcast, followed by loud claps of thunder and vivid and forked lightning; the thunder increased louder, thunder peal after peal, and lightning flash after flash, until 5 minutes to 4 P. M., when the wind veered round to N. E., and with it came torrents of rain, accompanied by hail, the largest of which was at least the size of a pigeon's egg—such a shower, of the latter, I cannot recollect ever before witnessing. The entire compound of my house was one sheet of irregular ice—millions of stones to be picked up in a few minutes. This lasted for an hour, and I have since ascertained that the Pluviometer indicated the fall of 1·50 inches. During the same night, we had another light shower of some ·06 or .07 of an inch. Strange that there was no depression of the Barometer: on the contrary, it had risen ·050 of an inch above that of the previous day. Can you account for this. The weather is still threatening. On Sunday evening, the sky was overcast with nimbi, with thunder and lightning, and again yesterday.

19.—HAILSTORM AT HYDRABAD (SINDE) ON THE 17TH APRIL 1852.—Lat. 25·22 N. Long. 68·22. E. Alt. 50.

HYDRABAD (SINDE) 23RD APRIL.—We hear from Hydrabad that that station was visited with a very heavy shower of rain, accompanied with hail, on the evening of the 17th April. The hailstones, we are told, were large, so much so as to startle the natives of the place.—*Kurrachee Advertiser, April* 23.

20.—HAILSTORM AT DELHI ON THE 17TH APRIL 1852.—Lat. 28 31 N. Long. 77·13 E.

20TH APRIL.—We had a violent storm of wind, rain, thunder and lightning, on the afternoon of the 17th; it lasted about six hours, during which much rain fell, and the lightning was very vivid and clear. We had another yesterday, accompanied by hail. I have not heard of any damage done. The weather is now cool again and still cloudy.

21.—HAILSTORM AT SATTARA ON THE 23RD AND 24TH APRIL 1852.—Lat. 17·40 N., Long. 74·2 E. Alt. 2,320.

A Correspondent at Sattara has kindly favored us with the following communication:—

Dear Sir;—As from your last number you do not appear to have been informed of the heavy fall of rain at Sattara on the 23rd April, I take the liberty of sending you a brief account

of it:—The sky until about 2 P. M. had been bright and cloudless; but shortly after, threatening clouds began to press together into a frowning mass; and at last, when all their batteries were in order, crash after crash of thunder, preceded by dazzling flashes of forked lightning burst forth, and, as all heaven was converted into one vast shower-bath, the streaming rain with hailstones, poured down with *inconceivable* violence. The plain was one broad sheet of water, and *literally* covered with hailstones: the river at Mahoolee, and the nullas, wells and tanks, were overflooded: chuppered huts thrown down and blown away, and chuppered roofs actually torn up from the rafters. The fury of the wind may be conceived from a *Dumnee* having been forced back some ten or twelve yards from its position! The poor doubtless have suffered to a *very considerable* extent by this storm—the like of which it would appear, never before in the memory of some of the oldest inhabitants, occurred in this locality. The heat, when the storm commenced, was 80°; during the interval that it rained, the mercury fell to 70°, and after it cleared up, it again rose to 75°.—A male convict in the Sattara Hill Fort was killed by lightning.—On the day following, the 24th, also, we were visited by a strong shower of rain and hailstones, though *comparatively far short* of the quantity that fell the day preceding. Since then we have had only intermittent, moderate passing showers.

22.—HAILSTORM AT SATTARA ON THE 6TH MAY 1853.—Lat. 17.40 N., Long. 74.2 E. Alt. 2,320.

We hear from Sattara that that station also was visited by a thunder-storm on Friday last, the day on which Poona was similarly favored. We regret to hear that the electric fluid struck a Peon of the Commissioner's Office whilst he was walking along the public road and killed him instantly. Hailstones of large size fell in abundance, and the wind blew a perfect hurricane for about an hour. The storm appears to have commenced at Sattara precisely at the time that it did here, and to have been of about the same duration.

23.—HAILTSORM AT LAHORE AND MEEAN MEER ON THE 11TH, 12TH AND 13TH MAY 1853—Lat. 31.36 N., Long. 74.24 Alt. 1,180.

MEEAN MEER, *May* 14.— Private letters inform us that on the nights of the 11th and 12th, and again on the afternoon of the 13th, Lahore and Meean Meer, &c., were visited by heavy and most welcome storms of hail and rain, which on each occasion lasted for some hours. They had thoroughly cooled the air; and one of our correspondents says—"what has become of all the flies I know not—please the gods the heavy down pouring rain we have been blessed with has destroyed the greater number of them—but, be this as it may, whereas up to the 20th instant they were so numerous as to amount to a positive plague,—such as Egypt knew,—not *one* is now visible even out of doors."—*Mofussilite, May* 19.

24.—HAILSTORM AT PESHAWUR ON THE 12TH MAY 1853—Lat. 33.59 Long. 71.40 Alt. 1,068.

We have had as usual very changeable weather. The first part of the week it was desperately hot, but the clouds got up gradually, and yesterday we had a slight fall of rain, which cooled the atmosphere a little. The clouds are still hanging about, and I dare say we shall have another fall. I see they have had a terrific storm at Ferozepore, just about the same time that we had a slight one here. It would be curious to trace the course these storms take; here it was very slight, but the damage done in the Eusofzye country is almost incredible. They sent in a report that 84 men and 3000 head of cattle had been killed by the hail. That unfortunate Eusofzye country! the people are trying to get the revenue remitted this year on account of the misfortunes that have befallen them, and I dare say they make out as strong a case as they can. We may expect soon to hear of the country being without an inhabitant, it was depopulated, and I don't know what not by the fever, and then came the hailstorm. It is true enough that a number of lives were lost by the hail, I believe; and the size and hardness of the hailstones that frequently fall here are really almost incredible.—*Delhi Gazette, May* 28.

The following is the letter from our Peshawur correspondent, dated June 4th:—

"The only news I can give you from this place is about the weather, and really it is so extraordinary here that one feels inclined to keep a Meteorological Journal. We had a series of dust-storms that commenced last Sunday, and continued for the three following days, coming up about 4 P. M., and on Thursday a tremendous storm of thunder and lightning, accompanied by hail, or rather I should say a fall of blocks of ice. Many of the stones were round, hard as granite, and 3 inches in diameter, but they were of all shapes and sizes. I no longer listen with incredulous ears to accounts of men and cattle being killed by hail. The stones too fell to the ground with such terrific force, that one of the larger ones would certainly have cut

a man's head open if unprotected. During the storm there was one of the loudest claps of thunder I ever heard. It went off in three reports like the discharge of a heavy piece of ordnance, and was accompanied by a flash of lightning that descended straight to the earth and entered the ground, I hear, within a few yards of one of the Regimental Magazines. Since the storm the weather has been pleasant, the Thermometer ranging from 80° in a house without tatties or thermantidote."—*Delhi Gazette, June* 11.

25.—HAILSTORM AT FEEROZPOOR ON THE 13TH MAY 1853—Lat. 30.57 N., Long. 74.41 E.

A Correspondent at Feerozpoor, writing on the 15th May, says :—"We had a very severe hailstorm here two days ago. Wind terrific, that there is not a single compound in the station that has not lost several trees, and many large branches. The hail killed, in one compound alone, *eighty-seven* birds of different sorts. The weather is now delightfully cool.'—*Lahor Chronicle, May* 18.

26.—HAILSTORM TO THE NORTH OF JUMMOO ON THE 13TH MAY 1853—Lat. 32.33 N., Long. 74.56 E.

On the 13th May in the midst of the rain, a terrific hailstorm burst over the highlands, north of Jummoo, destroying several villages, and upwards of 700 head of cattle. Altogether the loss in Cashmeere and its vicinity must have been very great by the floods and storms.

27.—HAILSTORM AT NAINEE TALL ON THE 21ST MAY 1853.—Lat. Long.

NAINEE TALL, May 23.—On the 21st, there was a heavy hailstorm, which made the Hills put on their winter coat of white for a few hours. But the sun soon melted it except a few patches where its rays could not penetrate. The south side is still covered with it. The season has been a very wet one, but the weather appears now to have become settled.

28.—HAILSTORM AT POONA ON THE 29TH MAY.—Lat. 18·30 N., Long. 74·2 E. Alt. 1,900.

Monday and Tuesday last, alternately sunshine and cloudy. On Wednesday till about 12 A. M., bright sunshine, when, till after 2 P. M. the clouds all around assumed a dark aspect—the lightning flashed most vividly—the artillery of heaven pealed forth most terrific thunders, and the wind from the north commenced blowing *most furiously*. At length the rains descended in torrents—the wind still blowing with unabated fury—and the combined violence of the wind and the rain was so very great, that many *chuppered* huts, despite all human endeavours to keep them standing, were laid prostrate ! The close of this downpour was accompanied with a shower of hailstones, which through the force of the wind, were actually scattered into some of the bungalows which have their doors to the north. The total fall of rain this day may have been about one inch.—Thursday, fair and cool. Friday and Saturday fair but warm. Sunday fair but *very* warm ; flashes of lightning after sunset, no thunder.—*Poona Observer, May* 29.

The storm which only threatened Bombay with a deluge, seems to have broken over Poona in all its violence about five o'clock on the evening of Tuesday last. It commenced with dreadful claps of thunder and lightning, followed by hail and rain, which lasted for some hours, and it was believed that at least a couple or three inches of rain must have fallen. A similar storm seemed brewing next afternoon, and the heat is represented as almost suffocating. Fever was very prevalent in camp.—*Ibid.*

29.—HAILSTORM AT SIMLA ON THE 23RD SEPTEMBER, 1853.—Lat. 31 6 N., Long. 77·11 E. Alt. 7,500

"We had a hailstorm of an hour's duration the day before yesterday, which had the effect of making the atmosphere very gloomy for hours, and the weather bitterly cold. Great coats were in universal requisition. September is always the gayest month in Simla, and this year it has I think exceeded any former one. The visitors from Umballa are lingering day by day, fearful of returning whilst the cholera rages there so fearfully. The dawk reaches us regularly now, which is a great improvement on the state of affairs we had to endure a month ago."

30.—HAILSTORM AT ROORKEE ON THE 7TH FEBRUARY 1854.—Lat. Long.

Such a wet uncomfortable season as it has been for the past fortnight we have not had for a long time. Hardly a day has passed but heavy clouds, rain or a humid breeze have damped our energies and drawn us round the fireside instead of enjoying the delights of the cold weather in athletic exercises and sports. On Thursday night and during the day of Friday there was a good deal of thunder and lighting, accompanied by a heavy fall of hail, which lasted about ten minutes, on the latter day, and incessant rain the whole of the day, the wind at the same time blowing a furious gale.

31.—HAILSTORM AT KURRACHEE ON THE 28TH JULY 1854.—Lat. 24·51 N., Long. 67·2 E. Alt. 10.

On Friday night, a smart shower of hail fell, accompanied by the most awful peals of thunder. On Saturday the weather was usually warm and oppressive—and about ¼ to 6 P. M., the vibrations of an earthquake were distinctly felt all over Kurrachee—houses and furniture rocked—it lasted for about two seconds—it appeared to proceed from East to West. From enquiries made, we learn that the shock was felt at Clifton and Munora also.—*Sindian, August* 2.

32.—HAILSTORM AT NEEMUCH ON THE 1ST DECEMBER 1854.—Lat. 24·27 N., Long. 75·0 E. Alt. 1,476.

NEEMUCH, *4th December.*—We had a severe hailstorm here on the morning of the 1st, accompanied with violent wind, and which did a good deal of damage, uprooting trees and unroofing houses.

33.—HAILSTORM AT JOONEER ON THE 6TH AND 7TH DECEMBER 1854.—Lat. 19·12 N., Long. 74.10. E. Alt. 2000.

On the 6th Dec., at 3 P. M., the Jooneer district was visited by a violent hailstorm succeeded by very heavy rain. The hailstones were of unusually large dimensions; the direction of the storm was from N. W. to S. E.—On the 7th Dec., at noon, a more Easterly part of the same district was visited by a still heavier fall of hail than on the previous day: the hailstones fell so thickly that they froze together and formed large ice flakes, which were carried by the natives for several miles and exhibited to their friends as remarkable curiosities. Very great injury has been done in the immediate locality of these storms by the hail, and by the torrents of rain which followed. The very promising cereal crops are destroyed, the fruit trees seriously injured and the fruit beaten off. The Sugar-cane crops have also suffered greatly, and it is even reported that several persons were killed during the storm, but whether by the electric fluid or by the hailstones is not stated.—*Poona Observer, December* 16.

34.—HAILSTORM AT POORUNDHUR ON THE 11TH DECEMBER 1854.—Lat. 18.42 N, 14 12 E. Alt. 3,500.

A severe hailstorm was experienced in the Poorundhur Talooka of this Collectorate on the afternoon of the 11th December. Number of persons were severely injured by the falling of large ice-flakes, many of them weighing several pounds, and cattle in considerable numbers have died from the effects of the storm which, for the time it lasted—about three hours—was the most severe of any within the recollection of the oldest inhabitant. The hailstorm was succeeded, as at Jooneer, by a very heavy fall of rain, and the grain crops, gardens, and fruit trees have suffered greatly therefrom. Poorundhur is situated at a distance of seventy miles South-east of Jooneer, but we have not yet heard that the intervening districts have experienced similar phenomena to those above described. There has been no particular atmospheric disturbance in or around Poona, the climate of which station is now delightful, as it always is at this time of year.—*Poona Observer, December* 20.

35.—HAILSTORM AT AURUNGABAD ON THE 24TH DECEMBER 1854.—Lat. 19.54 N., Long. 75.33 E.

A friend writing from Aurungabad on the 27th December, informs us that on the night of Sunday last, the 24th December, a most terrific storm occurred at that Station, attended with vivid fork-lightning, rain and hail. The season would appear from this to be quite out of joint all over the Deccan.—*Poona Observer, December* 30.

36.—HAILSTORM AT JESSORE ON THE 4TH & 5TH FEB. 1855.—Lat. Long.

Letters from Jessore mention that heavy rain fell on the 4th and 5th, and the planters have consequently commenced sowing. A violent hailstorm also occurred, which had done much mischief to the ryots' crops, and killed numbers of cattle. The rain seems to have extended as far as Patna, though it was partial in the Nuddea district and Burdwan.—*Englishman, Feb.* 10.

37.—HAILSTORM AT BOLARUM ON THE 3RD MARCH 1855—Lat. 17·27 N., Long. 78.35 E. Alt. 1800.

We take the following extract from a letter dated Bolarum, the 6th of March:—"We had a heavy fall of hail here last Saturday the 3rd; the trees are all quite stripped of their leaves, and almost every window with glasses may now be seen with one or two broken panes. The hail came beating right into the houses, and the ground was quite covered with it. The oldest European inhabitant here declares that he never witnessed such a sight before either in England or this country; at the Residency, twelve miles dis-

tant, there was not the slightest trace of the storm; at Secunderabad, which as you know is about midway. it was experienced in a much less severe degree than at Bolarum."

38.—HAILSTORM AT CAWNPORE ON THE 8TH MARCH 1855.—Lat. 26.28 N., Long. 80.23 E.

This station was visited with a severe hailstorm yesterday followed by heavy rain. We fear that the crops will suffer in consequence.—*Central Star, March* 10.

39.—HAILSTORM AT MEERUT IN MARCH 1855.—Lat. 29.0 N., Long. 77.45 E.

We are having most unusual weather for this time of the season. The rain which we generally have in February kept off the whole of that month, and since the beginning of the present one we have had too much of it; together with two thunder storms accompanied by heavy falls of hail. The hail has done no small amount of damage to the standing crops about the surrounding country, but also to our gardens, both fruit and flower.

It is worthy of remark that the hailstones which fell on these two occasions are said to be the largest that have ever fallen: and this remark is even made by the "oldest inhabitant." That they were uncommonly large no one can possibly deny, but when we are informed by the "oldest inhabitant" that they were the size of ostrich eggs, and weighed, each, four ounces, this assertion, most assuredly, admits of a doubt! The weather still continues very unsettled, it is neither hot nor cold, but very damp: heavy clouds are hovering about, giving us a fair promise of more rain.—*Central Star, March* 17.

40.—HAILSTORM AT HURRYHUR ON THE 12TH MARCH 1855.—Lat. 24.31 N., Long. 75 59 E.

A Correspondent at Hurryhur, writing on the 13th March, gives us some particulars of the weather there, which (briefly narrated) may interest our readers.

For several days prior to the 12th March, the atmosphere had been unusually close and oppressive; the cool wind from the Westward, which renders the climate of that station so agreeable during the hot season, having almost failed. This wind, we may observe—styled "our sea breeze" in that quarter—commonly springs up about half past six P. M., and blows all night, often continuing until after 9 A. M., next day. It is more refreshing than any breeze on the Coast, and grows so cold toward day-break, that additional bed-clothing and fires become exceedingly agreeable.—But to return to the particular accidents of the weather.

On the afternoon of the 12th March, heavy banks of clouds, charged with rain and lightning, were seen South West and North of Hurryhur. About 7 P. M., a smart breeze from the South sprang up, strengthening every minute, until it became strong enough to carry everything before it, and veering quickly round to the North, with heavy blasts which brought up blinding clouds of dust, dirt, leaves of trees, &c. "The wind then grew very cold," says our correspondent, "veering to the West. It increased in force and rain began to fall; soon followed by a heavy hailstorm, which lasted about ten minutes. Some of the hailstones taken up measured two inches in circumference. The squall was fortunately brief. It lasted long enough, however, to do much mischief, and the poorer classes have suffered in their houses severely. Many weeks will elapse, I dare say, before a number of them get a good roof over their heads again. I have not heard of any loss of human life, however, save that the finishing stroke was given to a man in hospital who had been long dying of consumption. Not a few birds have been killed, however. More than 270 were picked up dead in our garden this morning. But strange to say, the river banks were *covered* with dead fish, many of them being over a foot in length. They must have been attracted to the surface by the peppering of the hailstorm, and then killed by the stones, or do you account for it in some other way?"

41.—HAILSTORM AT CEYLON ON THE 8TH APRIL 1855.—From Lat. 5.56 to Lat. 9.46 N., and Long. 79.36 to 81.58 Long. E.

Yesterday evening at half past 7 o'clock the intense heat of the day was followed by a thunder storm and a welcome fall of rain. The lightning was exceedingly vivid and the peals of thunder heavy. One crash broke over the Fort, shaking the Light House and the houses in the Fort so much that the chunam of the ceilings fell in large flakes. The sound was as if a 32-pounder had been fired in the street, flash and report being simultaneous. We may now look for a fortnight's thunder showers more or less as is usual at this time, they are called the Singalese New Year's rain. The heat is excessive all over the Island during the day. At Colombo 80, 90 and 91 in the Fort, at Putlam 93, Jaffna 92, Aripo 93, Kandy 88, and Puselava 84 to 86. Probably for many years past the range of the temperature in so many parts of the Island has never been so high. The land wind still blows towards day light rather strongly.

The most unusual occurrence of a hailstorm in Ceylon has lately taken place. A few days since at Puselava following a thunder storm, a heavy fall of hail took place lasting half an hour; in some places where the wind drove the hail into corners whole handsful of hail, the size of marbles, were gathered. The Natives were struck with wonderment, and whilst shifting the frozen drops from hand to hand delared that it was so *hot* that they could not hold it. The hail actually for some minutes whitened the ground in many places. At Hunasgeria also a shower of hail fell on the same day, but not in the same quantity as at Puselava. Some years ago we saw a small fall of hail at Kornegalle, it is unknown either at Newera Ellia or at the Neilgherries.—*Ceylon Times, April* 13.

42.—HAILSTORM AT THYET MYO ON THE 14TH APRIL 1856.—Lat. Long.

THEYET MYO, May 21st.—We were visited on the 14th April by a great severity, which though its fury lasted only two hours, caused great injury to all the government buildings at this station. It was a regular cyclone going round the station, and caused additional injury from the wind suddenly striking from an unexpected quarter, in a point where measures for protection had not been adopted. Hailstones of a very large size were driven along almost horizontally, and the rain fell as one huge water spout. When at length the storm ceased and we could look around us, ruin met the gaze every where. All the barracks of the 29th were much shaken and injured, and two were blown right down, injuring thirteen soldiers. Many of the huts of the 65th vanished completely, and many of the officers' houses were unroofed and temporary outhouses blown away; and last though not least, the whole of the 25th N. I. lines were completely levelled. Eighty sepoys were at first said to have been injured, but only eight were admitted into hospital. The whole of the artillery stables were broken up or down, but only six horses were injured and three not severely. Since then we have had fine weather and repairs are rapidly progressing.—*Calcutta Englishman, June* 13.

43.—HAILSTORM AT FUTTEHGURH ON THE 21ST APRIL 1855.—Lat. 27.23 N., Long. 79.33 E.

A Correspondent at Futtehgurh, writing on the 24th April, mentions the occurrence of a severe hailstorm on Saturday last, which had effected considerable damage to the tobacco and melon fields. Our correspondent says the hailstones were larger than he ever beheld; one he measured being seven inches in circumference. Heavy clouds were hanging about at the time of writing.—*Delhi Gazette, April* 26.

A Correspondent writing to our Delhi contemporary, gives the following account of an hailstorm which took place at Futtehghur on the 21st April:—"Last Saturday we had an awful hailstorm, such a one as probably has not been known for a century. The hailstones without exaggeration, were larger than Turkey eggs, and sufficient to have knocked a bullock down. As they fell you saw them rebounding six feet in height. It is cloudy again to-day; some one told me the other day that this season is like the one preceding the great famine of 1837-38. I hope not"—*Ibid.*

44.—HAILSTORM AT RAMPORE BEAULEAH ON THE 23RD APRIL 1855.—Lat. Long.

We are told that the Station of Rampore Beauleah was visited by a severe North-Wester in the afternoon of the 23rd April, at about 7 P. M. The wind was high and rain heavy, accompanied by hail, which fell thick. A gentleman who was there at the time, describes the hailstones as of unusual size, as large as hens' eggs. They were kept for three days and used as ice. The *Mirzapore* steamer carried away two of her cables, but sustained no damage. The *General McLeod* and *Hooghly* were there too, but did not suffer in the least. The river is described as being in a much better state than usual at this season of the year. This, indeed, must be the case as we understand the *McLeod* made the run, with a heavy laden flat in tow, up to Allahbad and back in thirty days. It will be remembered it was on the morning of the same day, the 23rd April, we had our first North-Wester of the season. We believe that there can be but little doubt that the rains intend coming upon us earlier than usual this season. The *avant couriers* of which we have had more than one in Calcutta, and which, by all accounts, appear to have visited every part of the country, may be regarded as the *Chota Bursaut.*

45.—HAILSTORM AT CUTTACK ON THE 25TH APRIL, 1855.—Lat. 20.27 N., Long. 86.5 E.

The Ooreeahs in Calcutta from Cuttack are in great distress from recent news from their homes. Very severe weather towards the westward of Cuttack about three weeks ago, heavy hail, rain and a hurricane, which completely levelled a small hamlet near the village of Pyrukh and the Khursoodh river in thannah Bhuddruck, zillah Cuttack, not a house or hut was left standing, and the streams have overflowed the country, so that the people have not yet been able to plant any paddy, the depth of water every where is too great for the young plant—*Englishman, May*, 16.

46.—HAILSTORM AT CHITTAGONG, ON THE [illegible] APRIL 1855.—Lat. 21 to 23 N., Long. 91.38 to 93 E.

The following is from Chittagong, dated 25th April:—

"At three P. M., this day, after a violent storm of thunder and lightning, a shower of hail stones followed, covering the ground to the extent of several miles, and in some places they lay a foot thick. The choppers of native huts and the sides of the hills presented a most beauti-

ful and striking appearance. The ground looked as if a large sheet of surprizing whiteness was spread upon it. It is nearly ... hours ago and the stones have not disappeared or melted away. The natives say that they never witnessed such a sight before. What injurious tendency this may have upon plants and trees, it is impossible to say."

Another Correspondent from Chittagong says:—

"Ever since this new moon or Sunday before last, we have had constant rain and wind, night and day, and the weather altogether has been more like what we experience in the height of the rains in the month of July and August than anything else. But to-day's occurrence has crowned all. At three o'clock in the afternoon, it commenced, first raining slowly with a slight wind, which in the course of ten minutes swelled into half a gale, and with it came down or rather rained such a shower of hailstones as I have never witnessed before.

"The ground was literally covered with hail, and so much so that the grass could scarcely be seen on account of it. The trees were stripped of almost of all their leaves. The hail remained on the ground for about an hour after the storm had ceased. The weather has not yet cleared up?'—*Englishman, May* 1.

47.—HAILSTORM AT LAHORE ON THE 26TH APRIL, 1855.—Lat. 31.36 N., Long. 74.14 E. Alt. 1,180.

The weather still the subject of general speculation: early on Thursday we had a sharp fall of rain, with the usual accompanimenas of high wind, thunder and lightning, and during nearly the whole of the day it blew from the East, just as it blows towards the end of June, when the rains are at hand. During Wednesday night the temperature rose till at times it became "very hot" in the opinion of those even accustomed to bear with the heat. Towards four, on the afternoon of Thursday, symptoms manifested themselves of a storm gathering to the South-West. It approached very gradually, and then appeared to be turning to the North, but the sensible veering of the wind from East to North and North-West, pointed at a probable change in its direction. About half-past four a few heavy drops of rain, and the appearance of the clouds, heavily charged with electricity, seemed to indicate hail; in ten minutes more the signs became more defined, the wind increasing in intensity, and soon after small stones began to fall. In two minutes more the violence of the wind, the rain, and the hail were such, that no one could have ventured to face them. Birds fell struck to the ground by the immense stones, measuring, in some instances, close upon two inches in diameter, as if shot; unfortunate cattle, wandering about, were bleeding in all directions. Trees were snapped asunder as if mere sticks, many torn up; telegraph posts torn down: branches stripped of their leaves; flowers scattered to the winds, and the crops still standing beaten flat to the ground; in one short quarter of an hour the whole country, over which the force of the storm was expended, bore the appearance of a winter day in Europe, the hailstones lying in many places thick as snow. All the windows to the north in European dwellings, in the barrack, &c. were broken; hardly a chupper is to be seen in the town. In fact, desolation had set its seal wherever the storm passed. Its greatest force was felt east of the town as far as Shaleemar. The Garden of the Agri-Horticultural Society was fortunately beyond the worst of the storm, and has suffered comparatively little. The vegetables of the season, cucumbers, melons, &c., the tobacco and onions, lay in the fields as if ground, and in some instances not a vestige of green to be seen, so complete was the smash. It will, we suspect, be necessary to remit the revenue of those who have suffered. On Friday there was a calm, as if nature had been completely exhausted by the immense effort of the day. It is singular that not a stone or a drop of rain fell at Meean Meer.—*Lahor Chronicle, April* 28.

48.—HAILSTORM AT GOOJRA (PUNJAB) ON THE 23TH APRIL 1855.—Lat. Long.

We regret much to learn, that considerable damage has been done to the crops in the Goojra district by the late falls of hail.—*Englishman, May* 16.

49.—HAILSTORM AT PAUNCHGUNNY, MAHABLESHWAR ON THE 10TH MAY 1855.—Lat. Long.

We take the following extract from a letter from Totness Farm, Paunchghunny, near Mahableshwar, dated the 12th May:—"On the afternoon of Thursday the 10th May we were visited by a tremedous gale of wind, accompanied by a heavy thunderstorm and a perfect deluge of rain and hail from E. S. E., which lasted for upwards of an hour. The storm commenced at 3 P. M., and was at its wildest about 3 40. The lightning was terrific; one man was struck by it and killed, at a village two miles off; and here there were five head of cattle found dead after the storm abated. The hail covered the ground, and varied in size from the bigness of a pea to that of a nutmeg. The stems of the plantain trees in my brother's ground are bruised and battered from top to bottom, and the leaves of nearly all the fig and other young trees broken and destroyed thereby. Large branches of trees lie strewn about in all directions, broken off by the fury of the wind: several houses in the village have been damaged. The fall of rain during the storm could not have been less than three inches. During my brother's residence here he has never before experienced anything to equal the violence of this gale. Strange to say, Mahabuleshwar felt nothing of it; it seems to have expended its fury within a distance of six or eight miles, having commenced at a village three or four miles to the E. S. E. of Paunchghunny, and ended at another a couple of miles to W. S. W. The thermometer fell during the storm from 86° to 70°, and the weather since then has been

delightfully cool and pleasant. Prior to the 10th, it had been hot to a degree during the day, the evenings and mornings however being fresh and bracing. The oldest inhabitant does not remember ever having witnessed such violent gale as that above described"

50.—HAILSTORM AT NAINEE TAL ON THE 11TH MAY 1855.—Lat. 33·31 N., Long. 74·26 E.

On the 11th of May 1855, Nynee Tal was visited by a storm of hail, which as regards the size, weight, and number of the stones, has probably never been surpassed by any in the world. A calm, cool morning; a hot, enervating noon; a cold evening and night, with the wind blowing bleakly from the North, had characterized the few preceding days. The Barometer had stood high, and the wet bulb thermometer indicated an extremely dry atmosphere. On the 10th, at 4 P. M., the dry bulb thermometer stood under a grass chopper, at 80 degrees fahr; on the 11th, at the same hour and place, at 62 degrees fahr.! On the former date, the difference between the dry and wet bulb thermometers was 15 degrees; on the latter, this difference was reduced to 4 degrees! In the early part of the day of the storm, clouds had been gathering from the north and north-east, in the after part of it others travelled up from south and south-west, and appeared to coalesce with these. Towards 6 P. M., a small preliminary shower of rain fell, deep-toned thunder rolled and reverberated; and vivid lightning streamed and blazed over the devoted station. Innumerable bags of walnuts seemed to be pouring out their contents in the heavens; and men of science knew that hail was coming—and, presently, it came; ushered in by a few bright lens-shaped stones, as large as pigeon's eggs: then came more,—larger still; and whilst wandering Englishmen looked and thought, and startled Natives envoked "Purmesur, Narain," down fell a shower, of more than cricket ball size. Was it a delusion? To rush out, and seize a stone, to call for scales and tape, was the work of an instant. Many were the weighings and measurings of these monsters over all parts of the station. Some weighed 6; others 8; others 10 ounces; and one or two more than 1½ pounds avoirdupois, with circumferences varying from 9 to 13 inches. Men and animals fled for shelter; vegetable gardens became ploughed fields, with "something green" turning up here and there; the lake looked as if it were being besieged by endless batteries; or as if innumerable whales were blowing and sporting in its waters, so unceasing were the "jets d'eau" cast up by the falling balls of hail: and you sat in your house, listening to the roar above you, calculating upon the strength of beams and roofing: you tried to talk, but your neighbour couldn't hear you; so you sat, and thought of Vulcan, and the thunder bolts of Jupiter. Men who, hitherto, would have turned away from a story of bullocks killed by hail with a "credat judæus" smile and shrug of the shoulder, will now tell a similar tale; for though no bullocks were killed, a monkey was, and three human beings were knocked down. Birds were killed, trees barked, and houses unroofed. Such was the storm of the 11th May, and it forms an epoch in the meteorological history of Nynee Tal; for though hail is common enough here in the hot weather, no stones, (during the ten years that Sir W. Richards has kept a register) of any size have ever fallen, except once, and then they were only 2½ inches in circumference. Hailstones of pigeon's and turkey's egg size, have often fallen in various parts of the world, but, perhaps, the severest storm of any recorded, (and to which that at Nynee Tal is a parallel,) was one which occurred in Hertfordshire in 1697, and mentioned in the Philosophical transactions for that year. The relator says "I was walking in my garden, which is very small, about 30 yards square, and before I could get out, it took me to my knees, and was through my house before I could get in, * * * went through all like a sea, carrying all wooden things like boats upon the water, the greatest part of the town being under this misfortune. The stones measured from 1 to 14 inches about."

*What is a Hailstorm.*—Aqueous vapour condensed into ice, by passing through an intensely cold atmosphere, is the apparent, and probably the true answer. Some contend that, because hail falls so rarely in winter, and the cloud whence it comes is usually at no great altitude, there being at the same time almost always thunder and lightning, (with atmospheric electrometers changing in intensity) and passing from positive to negative, and *vice versa*, (ten times in a minute,) hence electricity must have quite as much to do in the matter as cold. But the latter seems the most reasonable view. In almost all very large hail stones, (as was observed here,) is found a nucleus; a piece of snow, or a small opaque hailstone in the centre, surrounded by transparent coverings, one over another, concentrically arranged, (like an onion); leading to the belief that the first concretion was a small one, and that it *accumulated* in its descent; that a whirlwind above kept battering these formations together, and prevented their falling, until at length, immensely enlarged, and getting out of this influence, they came bumping down upon "terra firma." We are not justified in assigning limits to the amount of cold in the upper

strata of the atmosphere; for look at "Halos" and "Parhelia," which are caused by the presence of frozen particles in the air, in latitudes where the temperature would not admit of the fall of Snow. At Nynee Tal, moreover, there had been, even on the earth itself, an immense fall in the temperature. There is a case on record where ice,—thick square and oblong pieces, with spiculæ projecting,—has fallen! See Fauquier's account of the storm in the Philosophical Transactions for 1798. The fall occurred in Virginia, whilst he was Lieutenant Governor there, and many an ice cream was made therefrom. But as, to your readers in the parched plains, this continued description of cold effects may be too tantalizing; and, as I cannot faire venir la glace a la bouche, I will say no more.—*Delhi Gazette*, May 17.

51.—HAILSTORM AT PATNA, ON THE 19TH MAY 1855.—Lat. 25.37 N., Long. 85.15 E.

From our correspondent:—" We have had a terrific hailstorm—coming from the hills the fall has been most extensive and has spread over the whole of the Districts between this and Nepaul range. The cause of this welcome refresher may be explained in the fact that the intense solar heat causes evaporation on a large scale within the limits of the Snowy range, and that the refrigerant masses so disturbed and borne upward flow cold currents towards the vacuum occasioned by the vertical rays over the region of the plains—where, condensing during the night, the mass of hail thus formed is precipitated in perfect storm by the heat of the following day. We have suffered considerable damage in the District in consevuence, but we must not complain considering so much good will arise from so welcome a change in the atmosphere which has been most oppressive.—*Central Star*, *May* 26.

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## ART. II.—*A Short Account of the Principal Arctic Expeditions, undertaken in England, by Sea or Land, betwixt* 1553 *and* 1854. By DR. G. BUIST, F.R.S., Secretary to the Society.

[Lecture in an extended form delivered 21st Dec., 1854.]

IT is not wonderful that in India we should sometimes let drop the recollection of trains of investigation, or slip occasionally a chapter or two in the annals of those classes of incidents which are only at intervals before the world at all. The chain of the narrative thus once broken, it becomes difficult in foreign parts to re-unite the links, and half the interest of passing events is lost, by others of the same natural sequence which preceded them having been forgotten. The intense and universal interest recently manifested in the case of Sir John Franklin, will illustrate my meaning: I doubt if one in ten of the community carry along with them the circumstances which led to the dispatch of the enterprise of which he was placed in charge— if one in twenty could give a tolerably clear account of the Polar Expeditions which preceded that of 1845. With a view of enlightening the minds of such as may never have been familiar with these matters at all—or refreshing the memories of those who may have once been acquainted with all desired to be made known, but have now become oblivious, I have drawn up the following narrative.

The earliest visits of navigators to the Frozen Regions were for the most part accidental, and the first knowledge we possess of the lands within the Arctic Circle was attained by men driven thitherward by stress of weather, or detained there by shipwreck. It was in the seventh year of the regin of Edward VI., 1553, that the London Merchants proposed to Government the

equipment of an expedition to discover a passage by the Northwest to India and China. The expedition consisted of three vessels of unusual strength, the command of which was entrusted to Sir Hugh Willoughby. They first reached Nova Zembla, and after knocking about for some time they found themselves on the coast of Russian Lapland, near the entrance to the White Sea. From this they steered westward, and were never heard of more. Another of the ships having entered the White Sea, and heard for the first time of the greatness of Muscovy, their Commander and crews made their way to Moscow in sledges, and were cordially received by the Czar. On their return overland to England, a copartnery was established, under the name of the Muscovy Company. In 1556 a second expedition sailed from the Thames, with the same objects as the first: the expedition altered its views, and returned before having got so far north as that which preceded it. Various expeditions from England and Holland succeeded this, with no more success than those which had gone before. In 1607 Captain Henry Hudson was dispatched by the Muscovy Company on the usual quest: he passed near Iceland, reached the shores of Spitzbergen, and examined the coast of Greenland from 81° to 82° W.: he returned in September, having made a splendid addition to our knowledge of Arctic Geography. In 1613 Baffin added largely to the information Hudson had collected: the names of the two will go down together to the end of time, blazoned on the maps of the world. I may now skip over the voyages and discoveries of two centuries, as threatening to draw too largely on our space, and come to the discussion of those of our own time, commencing with that of Captains Ross and Parry in 1818, with the ships *Alexander* and *Isabella*, which form the first of the series of which it is to be hoped that of Sir John Franklin's will be the last. The expedition sailed in the middle of April: they were only absent a single season, having returned in October with a large stock of information, and Captain Parry strong in the belief that Lancaster Sound opened the way to such splendid discoveries that its examination, which had scarcely been begun, ought to be resumed. In 1819 accordingly the young officer just named was entrusted with the command of the ships *Hecla* and *Griper*, with the view of renewing his investigations. He proceeded straight for Lancaster Sound, and sailed for a long stretch in open water, without interruption, to within three degrees and a half of the Pole. From the heavy swell which still rolled in from the North-west, and the oceanic tint of the waters, they now believed themselves on the verge of the vast iceless polar basin, and on the highway of rounding the northern extremity of America, and so reaching the Pacific. Here in lat. 75°, however, they were suddenly and absolutely stopped by vast towers of ice. Having reached Long. 110° W.

they became entitled to the £5000 promised to the first shipwhich touched this meridian in these latitudes. During the next ten months scarcely any thing was effected by him, and the expedition returned to England in October 1820, without having succeeded in the great object in view, but having at the same time attained so large a measure of success as to lead to a second expedition under the same command : only one man had died on board during their absence. The ships on this occasion consisted of the *Hecla* and the *Fury*; —the latter of these being placed under the command of Captain Lyon,—an officer who had distinguised himself as a geographer on the African coast. They sailed in May 1821 : on reaching Hudson's Straits they were surrounded by such masses of ice that it took them nineteen days to traverse seventy miles. After numberless toils and perils they returned to England in October 1823, having spent two winters in the ice : the discoveries once more made by them were deemed well worthy of the expedition. Two of the attempts that had been made to penetrate beyond Lancaster Sound had each to a certain extent proved successful—each had been eminently promising, and each productive of a large amount of secondary fruit. The spirit of the country had been awakened on the subject, and the public were anxious to push on in a career of discovery which at this time seemed so promising. In 1824 accordingly a third expedition under Captain Parry was dispatched, with the old ships *Hecla* and *Fury*—the latter, in the absence of Captain Lyon from the country, was placed under the command of Lieutenant Hopner. They left in May, but from the obstacles to be contended with, did not reach Lancaster Sound till September, and here they resolved to winter. They were able to warp out and put to sea in July ; when, in Lat. 72° 42', Long. 91° 50', the *Hecla* became disabled during a storm, and required to be abandoned. This necessarily put an end to the expedition. The *Fury* returned to England with the officers and crews of both ships. The Admiralty had at length become wearied of Polar adventure, and when applied to by Captain Ross, declined to afford assistance from the public purse to promote an expedition meant to remedy the errors committed by him in that of 1818, and to retrieve the reputation that had then been injured. A private merchant, Sir Felix Booth, came forward to perform that which the authorities declined, and in 1829 a steamer of 150 tons, called the *Victory*, was purchased, fitted up and placed at his disposal ; and with this in the month of May he and his nephew (afterwards Sir James) started on their journey. The vessel seems in every way to have been ill suited for the service : her steam machinery proved useless, and she lost her mizen mast and was nearly wrecked before reaching Greenland. Near the Danish settlement of Holsteinborg, lat. 66° 8', long. 53° 54', they found the wreck of a London whaler, from which they were able to repair

and refit the *Victory*, and recruit their supplies. In the middle of August they reached the place where the *Hecla* had been wrecked; and though every trace of the vessel herself had disappeared, preserved meats, wines, spirits, and other stores, were found piled up on the beach, as fresh and good, after the lapse of four years, as the day on which they had been put on board. This second piece of Providential fortune saved the expedition: the *Victory* excepting as a home was next to useless—their explorations were nearly all conducted over the ice or by boats. The most striking of their discoveries—the only one indeed of any considerable moment—was that of the position of the Magnetic Pole in Lat. 70 ° 5'7" N., Long. 66 ° 46'45" W.,—six miles further north, and two degrees more westerly, than the position theoretically assigned to it. Here the dipping needle pointed perpendicularly, and the compass needle swept round without any polarity. After many hardships, privations, toils, and wanderings, the explorers made their way to Baffin's Bay, and stood out in their boats to sea:—they were on the 26th August picked up by the *Isabella*, a Hull whaler which Captain Ross had himself formerly commanded. They reached England in October 1833, after an absence of nearly four years, having spent three winters amongst the ice. A few months before the return of Captain Ross's expedition, Captain Back who had shortly before accompanied Captain (afterwards Sir John) Franklin in an expedition overland, started in quest of the missing navigators, who had turned up before he had well entered on his travels. He proceeded, however, with his explorations, and returned to England in October 1835. With these close the Arctic Expeditions, up to the time of the despatch of that, the fatal tidings of which have so lately reached us.

Want of space compels me to pass over the discoveries of Captain Scoresby, and to confine myself to expeditions connected in some way with that towards which public attention was for so long so anxiously turned. I must not, at the same time, overlook the attempts made to penetrate to the northward through Behring's Straits, betwixt Asia and America. This had been a part of the project of Captain Cook, who in 1779 reached latitude 70 ° 41; where he was stopped by a barrier of ice, apparently impenetrable: a second attempt, made after his death by Captain Clarke the following year, was still more unimportant than the first. So far back as the days of Forbisher it had been the general opinion that Greenland was an island, or group of islands—that there was a great polar basin, free of land, and most probably of ice, which; once reached, would leave an easy passage through. The Russians would be saved a voyage of 18,800 miles in visiting their North American settlements, could they reach Behring's Straits by the Pole in place of by Cape Horn. Captain Pettingal had been deputed to Baffin's Bay in 1776, in hopes of proceeding in the direction afterwards followed by Ross and Parry, so as to assist Captain Cook,

approaching from the opposite side of America.[1] He took the alarm at the ice when in lat. 68°, returned to England, and was suspended : the same vessel was next year sent to Baffin's Bay under Captain Young, but with similarly unsatisfactory results.

I have purposely abstained from noticing the overland expeditions made contemporaneously with the investigations of Ross and Parry, to enable me to give consecutively the Arctic adventures of Franklin from 1818 to his departure from England in 1845.

Simultaneously with the dispatch of the *Isabella* and *Alexander* under Captains Ross and Parry, in 1818, with the view of discovering the N. W. Passage, the *Dorothea* under Captain Buchanan, and *Trent* under Lieutenant Franklin, were sent forth with the view of making direct for the Pole. Both expeditions were provided with savans of distinction—Captain (now Lieutenant Colonel) Sabine, of the Artillery, the greatest magnetician of his time, accompanied Captain Ross : Captain Buchanan was accompanied by Mr. Fisher, of Cambridge. Ample stores of apparatus and instruments were placed at the disposal of each, and the services of two distinguished artists, Beachy and Hopner, who were placed as draftsman on board. In the year 1817 the coast of Greenland, believed to have been closed up for four centuries with ice, was found all at once to have become clear from the 70th to the 80th parallel : from the latter the sea to Spitzbergen was left open—the shore had been sailed along and examined by a Hamburgh trader, and it was this which suggested the two expeditions, the failure of the only attempt ever before made to reach the Pole direct, that of Lord Mulgrave, not being supposed to afford any sufficient reason against a second trial. The *Dorothea* having penetrated as far north as 80° 32', sustained so much damage from the ice during a storm that the navigators were compelled to return to England. This is the last attempt that has, so far as is known, been made to reach the Pole direct by sea.

The unsuccessful voyage of Captain Ross in 1818 has already been noticed, as well as the voyage of Captain Parry, undertaken the following year, with the view of penetrating Lancaster Sound, when the navigators attained the longitude of 111° W. It was at this time determined by Goverment to send an expedition overland from the shores of Hudson's Bay, to explore the northern coast of America, from the mouth of Coppermine River to the eastward, so as to continue the survey towards Lancaster Sound, where it was hoped Captain Parry might be met in with : that officer had, however, though in the same longitude, pushed five degrees north from the shore. Dr. (now Sir John) Richardson was appointed Surgeon and Naturalist to the expedition : Midshipmen Hood and Back formed its junior components—the former of these was prematurely cut off during the journey, and the name of the latter has since

been placed high in the list of Arctic discoverers. The party quitted England in May 1819 : they reached Davis's Straits in the end of July. They proceeded from Fort York to the mouth of the Coppermine River, lat. 67° 47', long. 115° 36' W., on the shores of the Polar Sea, which they reached in July 1821, having made numberless excursions from the direct track, and collected a vast amount of most important information in the course of their explorations. They journeyed eastward from this to long. 109°, lat. 68° 18', sometimes coasting in canoes, sometimes traversing the ice or snow, over a distance, including the irregularities of the coast, of nearly 600 miles, when, seeing no prospect of further progress, they returned. Their provisions became exhausted—their canoe was dashed to pieces—some of their Canadian guides grew mad from fatigue and famine, or died of hunger : one of them shot Mr. Hood to death, and the whole party had as nearly as possible perished. After enduring with wonderful fortitude and patience the most fearful toils and privations, they reached Fort York Factory in July 1822, and returned thence to England after an absence of above three years. The expedition had been conducted most ably, and was rich in fruits of discovery. At Port Mahon again the dipping needle stood at 89° 30', showing how near they were to the magnetic pole : the Aurora Borealis, when its light was brilliant, was found to affect the needle—a fact for the first time satisfactorily made out. Towards the close of 1823 another attempt to effect a northwest passage having been determined on by Government, the *Hecla* and *Fury* were, as already explained, dispatched under charge of Captain Parry ; and Captain Franklin laid before Government a plan for a second overland expedition, to explore in concert with this the shores of the Polar Ocean. The Hudson's Bay Company, on being communicated with, undertook to push forward a party to construct a place of reception and collect provisions for the expedition on the Great Bear Lake, where they were to quarter for the winter, from its vicinnage to the mouth of the McKenzie river. Captain Franklin started on his third Arctic and second overland expedition in February 1825, accompanied by his old companions Richardson and Back, with Mr. Drummond and four marines from Liverpool. They were received with the utmost kindness in New York, and the warmest hospitality throughout the States. They reached the Buffaloe Lakes in June, and the Great Bear Lake in September. They proceeded twice by the McKenzie river. to the sea. The new establishment on Bear lake had been named Fort Franklin beforehand, and as the season advanced the expedition returned, and here they spent the winter, in lat. 65° 11', long. 123° 12'. It was June 1826 before the country was sufficiently open to permit of their quitting their quarters. Having once more descended the McKenzie river in boats they reached the

sea in July, and dispersed themselves on survey along shore. In the course of the season they were able to carry their survey from 110° to 149°: from the latter point, at lat. 79°, they turned off in the middle of August, in consequence of the severity of the weather, to resume their winter quarters: they had traversed about three thousand miles during their absence. Dr. Richardson had conducted a second division of the expedition with equal success and skill in an opposite direction. On the arrival of spring the expedition turned their attention homeward, no more remaining to be done in this direction: they reached Liverpool in September, after an absence of two years and seven months. No casualty had occurred during the expedition, but two of the men died on their way from America.

In February 1825, H. M.'s Ship *Blossom*, under Captain Beechy, was dispatched from the Pacific and Behring's Straits to co-operate with Parry and Franklin,—the one engaged by sea, the other by land, in Arctic research, as already related. After a vast number of adventures of the utmost interest in the Pacific, they proceeded to the northward, penetrated Behring's Straits, and reached Icy Cape in August 1826: they reached latitude 71° 07', when the boats were dispatched to the north-eastward. On the 10th Sept., they returned, having been as far as 71° 23' 31" N., and 156° 21' 30" W.—beyond this they found it impossible to penetrate. Just about this time Captain Franklin and party had reached 149°, so that the two bands of explorers advancing along the American shore from opposite directions, were within six and a half degrees of each other. The *Blossom* in September returned to San Francisco in California. After a season spent in a long series of the most interesting enquiries in the Pacific and China seas, Captain Beechy early in 1827 pushed along the Japanese waters to renew his Arctic researches. He reached Kotzebue Sound in August: on this occasion they were unable to penetrate further than lat. 70° 41'—a degree and a quarter short of last year's advance, when they found themselves arrested by one vast impenetrable barrier of ice. The *Blossom* returned early the following season to England, having completed a magnificent scheme of research independently of the investigation on which she was specially commissioned. The parties of Franklin and Parry had returned before her—both unsuccessful in their main objects of discovery in the polar basin and a northwest passage, but both enriched with discoveries of extreme value.

An attempt was soon after this made to reach the Pole in a considerable measure over the ice. On the 27th March 1827, a party under Captain Parry started in the *Comet* steamer for Hammerfast: on the 22nd June they quitted the vessel, which was now beset in frost, and betook themselves to their travels. After the most incredible exertions they were able to attain

the parallel of 82° 40', when they found themselves compelled to return. Notwithstanding the magnificent additions that had been made to the geography of Polar America, the spirit of enquiry was far from being allayed. In June 1836, H. M. S. *Terror* was dispatched for Baffin's Bay, under command of Captain Back, with the view of proceeding to Repulse Bay or Wager Inlet: an exploring party was from this to be sent northward across the supposed isthmus to the Arctic Sea, with the hope of coasting along and determining the outline of the unsurveyed portion of the northern shores of America. They reached Baffin's Island in the middle of August. The *Terror* speedily got so packed up amongst the ice as to be wholly at the mercy of the winds and waves, and beyond the control of the crew. In this state she continued till the following spring, when so much time was found to have been lost, and so great injury sustained by the ship, that she returned home in September 1837, not having let go anchor since she left fifteen months before. Her greatest northing had been 73° 40', in lat. 65° 48'. During this year an overland expedition was undertaken by Messrs. Simson and Deas, of the Hudson's Bay Company. They first proceeded westward, and completed the line of survey in the direction of Behring's Straits, until they united Franklin's with the previous discoveries. They then descended the eastern branch of the McKenzie river, and took up the enquiry in lat. 109°, the easternmost point attained by Captain Franklin,—and thence proceeded for about ninety miles eastward towards Hudson's Bay—a further line of thirty miles of coast, opening out on a fine open sea, having been examined. A second expedition, by the same parties, occupied them up to the end of 1839, when all the objects originally contemplated were fulfilled. In awarding the Medal of the Geographical Society to the adventurers, the President stated that from Behring's Straits eastward to the 106th degree of west longitude the American polar coast line could be laid down with perfect confidence on the maps through the space of upwards of sixty degrees of longitude. The only portion of the coast thus left to be examined was a small fragment betwixt the last of the explorations just noticed, and that adverted to in the notice of the voyage of the *Hecla* and *Fury*, (p. 28,) surveyed to 91° 50' W., and lat 72° 42' N.

By this time Sir John Franklin had been appointed Lieutenant Governor of Van Dieman's Land, and was able to afford to his former fellow labourer in the cause of Arctic Discovery, Sir James Clarke Ross,—in 1840 placed in charge of the Antarctic Magnetical Expedition,—the most valuable aid in the establishment of an observatory at Hobart Town and promotion of his researches generally.

In 1845 a further attempt was, on the recommendation of Sir John Franklin,

who had some time before this returned to England, resolved to be made to discover the Northwest Passage, or to penetrate to the Great Polar Basin; and the *Erebus* and *Terror*,—the former under the command of the gallant officer just named, the latter in charge of Captain Crozier, who had shortly before returned from the Antarctic, where he commanded the same vessel under Captain Ross—were accordingly prepared for dispatch. They sailed in May, and were attended as far as Barra and Rona in the Hebrides by the steamer *Rattler*: the transport *Baretto Junior* accompanied them to the ice with a supply of spare stores, which were then put on board of them. They were provided with steam engines of small power and screw propellers, which gave them a speed of three miles an hour. In August they were to the northwest of Greenland, where it is believed they passed the winter. The remains of their camp were discovered at Fort Rielly in 1850 (p. 37.)

These were the last accounts received from the expedition, and the long continued silence began towards the close of the year 1847 to excite apprehensions regarding them. The following spring Sir John Richardson, the medical attendant, naturalist, companion and coadjutor, of Franklin in his overland expeditions of 1819 and 1825, resolved to proceed in quest of him. He left Liverpool in March 1848, accompanied by Dr. Rae—an able and experienced officer of the Hudson's Bay Company. They proceeded by New York, Lake Superior, and so on by Slave Lake and Great Bear Lake, to McKenzie River, which they descended to the sea; the shores of which they reached on the 3rd August. On the 10th they rounded Cape Bathurst, 70° 37' N. The winter set in prematurely, and on the 3rd September they found themselves compelled to return to Fort Confidence. The Esquimaux whom they met in with stated that they had neither seen nor heard anything of the ships or of white men in those seas, so that the journey was fruitless as to its principal object. They resumed their labours in May and June the following year, but equally without results. Sir John Richardson returned to England in the end of the year—Dr. Rae, having been appointed to the charge of the McKenzie River District by the Hudson's Bay Company, remained behind, bent on continuing his inquiries to the last. He pursued his investigations as late in the season as the weather permitted, but could learn nothing of the missing voyagers. While Dr. Rae was examining the coast from the McKenzie River, westward, a very adventurous journey of a similar description was being performed by Captain Pullen to the east as far as Herschell Island, 104° W., the vast extent of coast examined on these four several occasions furnishing no trace or whisper of Franklin. Captain Pullen renewed his searches in 1850, but found the ice so hunmockey that he was unable to reach Fort Bathurst, and wrote in October that his la-

bours had been most unsuccessful. On the 23rd March 1853 Dr. Rae left Liverpool for New York on a third overland expedition to the shores of the Polar Seas, the rest of which will be found near the end of this memoir.

The Admiralty about this time offered £1000, and Lady Franklin £2000, to any one who would first bring tidings of the missing adventurers. In May 1848 the *Enterprize* and *Investigator*, of 470 and 420 tons respectively, were dispatched, under the command of Sir James Clarke Ross—the nephew and companion of the officer who had been absent in the polar regions from 1829 to 1833, and subsequently the commander of the Antarctic Expedition of 1839-43. Instead of the screw propellers with which the *Erebus* and *Terror* had been fitted,—the present vessels, which were larger than these, were each supplied with a launch so provided, and which on being made fast amidships tugged at the rate of seven knots an hour. The vessels were provided with every appurtenance for safety as well as research that could be desired, but their duties were restricted to those of enquiry only. They reached Disco Island on the 2nd July; in the end of August they had cleared the main Pack in Melville Bay. Despatches shut up in a cask and thrown overboard were picked up by a whaler and received by the Admiralty in October. On arriving at Fury Point the remaining stores of the *Hecla*, (p. 28) with the poles of the tents and other structures close by, were found, after the lapse of thirteen years, in perfect preservation. Sir John Ross wintered in the ice; while in these regions he burnt bluelights, sent up rockets, and fired guns on all convenient occasions, and sent out boat expeditions in every direction—all in vain: not the slightest trace of Franklin or his people could be found. The search was however considered imperfect, and much dissatisfaction was expressed on its return. Sir James Ross at one time proposed to send back the *Investigator* and continue with the *Enterprise* for another season. In May 1849 the *North Star* was dispatched by the Admiralty with supplies of provisions. Some difficulty in corresponding with Captain Ross having been apprehended, this vessel was directed to throw over air-tight cylinders from point to point, containing full instructions as to what was desired to be done. The expedition was to consider its actual work only commencing:—both ships were to continue their explorations, the *North Star* to return with the tidings of what they had accomplished. The vessels missed each other, and while Ross returned home, the *North Star* remained out till October 1851.

In the beginning of 1848 the *Plover* was sent out from England, she was directed to proceed to Behring's Straits to pursue the enquiry from the west eastward; and the *Herald* was dispatched next season to supply her with all sorts of stores, so as to enable her to spend the winter of 1849-50 amongst the

ice, as it had been determined that the previous winter should be spent. The *Herald* returned from the first portion of her research in December 1849, without any tidings of the adventurers. The *Plover* was so dull a sailer that she had got no further north than Calloo in July—it was November before she neared the Straits, and by this time the icy sea was closed.

In August 1849 the *Plover* reached latitude 72° 51' and longitude 163° 48—the greatest northing ever attained from Behring's Straits, considerably above what was laid down by Captain Beechy in 1827 as the line of compact ice; from this, whale boats were dispatched for the mouth of the McKenzie river. The two ships returned in November to Kotzebue Sound, where the *Plover* prepared to winter. The ships *Enterprize* and *Investigator* which had just returned from Hudson's Bay under Sir J. Ross, where they had sustained no injury from the ice, were in January 1850 put in commission for a new expedition by Behring's Straits, under Commanders Collinson and McClure; they were provided with three years' supplies, and left on the 15th for Cape Horn,—thence to the Sandwich Islands,—where they were to await further instructions from home before joining the *Plover*. The expedition was provided with a large supply of balloons intended to convey information—these were to be sent up with some hundreds of slips of bright coloured paper attached to them by slow matches, to be disconnected at various elevations,—each paper containing the intelligence meant to be conveyed. It was supposed that these would become so diffused that there was every likelihood of some of them being secured.

Lady Franklin now encreased her offer from £2000 to £3000: she herself visited all our ports whence whaleships are dispatched, eagerly enquiring for information and endeavouring to stimulate the ardour of the polar navigators in the cause of enquiry. She memorialised the Emperor of Russia and the President of the United States on the subject; and the former having consulted the imperial academy of sciences, directed an expedition to be fitted out to examine the shores of Siberia and Nova Zemla: Congress at once voted a sum sufficient for the prosecution of the proposed enquiry. Two brigs, the *Advance* and *Research* were equipped under the auspices of Mr. Grennell, who himself subscribed $6000 to assist: they were dispatched early in May 1850 for Behring's Straits, in charge of Lieutenant DeHaven: they were provisioned for three years.

On the 23rd March 1849 the Admiralty made an offer of £20,000 for any one who could procure relief for the missing adventurers—a sum more worthy of the nation than the pitiful thousand pounds previously proposed: this was in addition to the charges of the *North Star*, estimated at £12,680. The offer unfortunately was too late for the season—nearly all the whalers had

left before it was made. In April 1850 the schooners *Resolute* and *Assistance* were dispatched under Captain Austin: they were accompanied by two steamers of sixty horse power, capable of affording a speed of six miles, and provided with three hundred tons of coal,—and these were to tow the other ships to the edge of the ice and conduct the search along with them: store ships were to accompany them, leaving them a supply of three years' provisions on their separation.

Dr. Goodsir—a member of a talented family, of whom the Professor of that name is one of the most distinguished—was the medical attendant to Sir John Franklin; and his brother Robert, a young Surgeon, in his anxiety to obtain tidings of the adventurers, sought and found a place in March 1849 on board the whale ship *Advice*, commanded by Captain Penny,—and it was at this time the officer just named became known as an explorer. In April 1850 he was entrusted with the charge of two vessels, the *Lady Franklin* and *Sophia*, to co-operate with Captain Austin; and with these he started on the 13th April, to act in concert with, and under the command of, that officer. The joint expedition, as will be seen presently, returned in September 1851. In May, Captain Forsyth was dispatched in charge of an expedition supplementary to that of Captain Austin—in command of the *Prince Albert*, a small schooner of 89 tons, fitted out from Aberdeen by private generosity, and given to Lady Franklin. He spoke the ships of Captain Austin, and returned in safety in October, without having once dropped anchor during his four months absence. He was the first to find the trail of the *Erebus* and *Terror*. Amongst the traces of a British encampment at Fort Rielly, some portions of hempen rope were identified: bones pronounced those of oxen such as supplied the salt beef of the expedition; and the marks of tents were made out as those of the magnatic observatory with which the expedition had been provided. They were supposed to have been left there in 1845-46. Slight as these traces were, they added fresh energy to the spirit of investigation: the *North Star*, dispatched in May 1849 to assist Sir J. Ross, returned in October 1851, in excellent condition, and was ordered at once to prepare for a voyage to Behring's Straits, to join and assist the *Plover*, a destination soon afterwards changed to Baffin's Bay.

The combined expeditions had been particularly requested to penetrate if possible the western channel and Jones Inlet, and the former of these was ascended by the American ships in 1850 as far as 75° 25' North lat. There were five miles of open water at one time seen in the channel, and it was affirmed on board, that then if ever, it might be considered clear of ice. In spite of this, Captain Austin abandoned all examination of this part of the coast, and spent the season exploring Jone's Sound: next year Wellington

Channel, which Captain Penny believed perfectly penetrable and likely to have been that ascended by Franklin, was found closed. Capt. Austin and his party returned in September 1851, when the greatest dissatisfaction was expressed throughout the country with their proceedings. The only fact of importance elicited on this occasion, was the exact position in which Franklin had spent the first winter in the ice, leaving little doubt to his having ascended the channel left unexplored though open in 1850. A committee of enquiry now sat on this subject, the report of which was published. It recommended that a further expedition be equipped in 1852, to examine in the direction of Wellington Strait, to remain at sea if necessary till 1853.

Amongst the striking cases of blundering traceable amongst those investigations is that of the misapprehension in reference to where information from the missing explorers was to be looked for. Search was made UNDER the cairn: it turned out that it ought to have been at some distance from it, in the direction indicated by the finger-post.

In May 1851 the *Prince Albert*, the property of Lady Franklin, started a second time from Aberdeen for the Polar Seas. She was on this occasion commanded by Mr. Kennedy, a skilful, intrepid, and experienced navigator. She reached lat. 51° 30' N., long 57° W. in the beginning of July—the commander full of hope of doing good service in the cause, in which his whole soul seemed engaged. Lieutenant Bellot, of the French Navy, had volunteered his services on board. In the middle of October Mr. Kennedy, with a number of his people, were left behind by the sudden drifting of his ship to the south, and imprisoned in the ice near Port Leopold, and it was by the intrepidity and immediate exertions alone of Bellot that they were rescued. It was by an accident parallel to that from which he saved his friend that he himself lost his life the year after.

I have omitted the voyage of the yacht *Nancy Dawson* which was in our harbour for some months in 1848 on a cruise round the world,—proposing to attempt to penetrate Behring's Straits. Her voyage, which did not promise much in the way of discovery anywhere, was cut short by the demise in 1850 of Mr. Shedden, her owner and Commander, before reaching the cold latitudes.

All the expeditions which had been in quest of the missing adventurers having thus returned without success, Lieutenant Pim afterwards the last to quit and the first to meet McClure, proposed to pass over to Petersburgh during the winter and push on to the extreme verge of Siberia on the snow,—thence endeavouring to make his way over the ice or by canoes or boats as far north as possible. Admiral Beaufort approved of, H. M.'s Lords of the Admiralty declined to countenance, the plan. Lady Franklin having advanced £500 to assist the proposed explorer in his task, he was refused per-

mission by the Emperor of Russia to proceed, on the humane plea that he declined sanctioning almost certain loss of life in an adventure so desperate, but would use every means in his power to see and promote the objects in view.

In 1850, 54,000 dollars were subscribed in the United States, for the purpose of forwarding an expedition to the Arctic Regions. To this Mr. Grennel, a distinguished New York merchant, added 6,0000 dollars. But delays arose, and the wishes of the subscribers not appearing likely to be realized, in any reasonable time, Mr. Grennel resolved to take on his own shoulders the whole expenses and responsibilities of the investigation. Accordingly, in May 1850 the two brigs *Advance* and *Rescue*, of 144 and 91 tons respectively, were got ready for sea. They were commanded by Lieutenant DeHaven, of the United States Navy—with Dr. Kane, a man of great energy and accomplishments, as medical officer, and naturalist for the occasion. They reached Baffin's Bay in the beginning of July, and pushed on through innumerable obstructions to Melville Bay, reaching the mouth of Wellington Channel almost simultaneously with Captain Austin's squadron, which had left England in April, having penetrated as far as 75° 24' N. Their instructions were, not to get frozen in, but to return as winter approached; and accordingly, after having been twice drifted almost embedded in a floe of ice, traversing in a state of utter helplessness above 1000 miles, from Lancaster Bay south into Baffin's Bay, they started homeward, and reached New York on the 20th September, without mishap, and with a large store of geographical and other information. It was to the exertions of Lieutenant DeHaven, combined with those of Captains Ommaney and Penny, that the discovery of the interesting relics of April 1846, at Fort Reilly, are due. The officers of the expedition felt sanguine that the rescue of those of whom they had gone in search was very far from hopeless.

The princely New York merchant had declined in the most grateful terms accepting a testimonial proposed for him in England, and stated that he could not accept reward for having done no more than his duty; and he directed the amount subscribed to be employed in the prosecution of further researches. On a subsequent occasion, when the Admiralty seemed likely to despond, he wrote to England stating that he had far from given up hopes, and should not abandon exertion till a much more minute search than had hitherto been attempted had been accomplished.

In the spring of 1852 an expedition, consisting of four ships and two steamers was ordered to proceed to the Arctic Seas in charge of Sir E. Belcher. These consisted of the *Assistance* commanded by the Officer just named; the screw Steamer *Pioneer*, the provision ship *North Star*, Commander

Pullen, the *Advance*, Captain Kellet, and the *Intrepid* screw steamer Commander McClintock.

The fate of Captains Collinson and McClure, who had sailed from England in January 1850, and not been heard of from the time of entering Bhering's Straits, was beginning to become matter of deep anxiety; and inquiries after them were now to form a portion of the new expedition, added to those after the fate of Franklin whom the Officers just named had been sent to look for. Beechy Island was the first point to be attained, and here the *North Star* was to remain as a store ship. Sir E. Belcher was then directed to endeavour to pass up Wellington Channel with one sailing ship and one Steamer, with a view to obtaining tidings of Franklin, and to send a similar force to Melville Island to inquire after Collinson and McClure. He was only to remain two years out; but on the remonstrances of Lady Franklin with the Admiralty, it was in March 1853 resolved to send instructions to him to continue, if deemed necessary, his search for another year.

He found fittting winter quarters near Cape Beecher, lat. 76° 52' N. long. 97° W., where he left his ships in the end of August, and proceeded in a whale boat and sledge expedition across the ice, reaching as far north as a group of islands 78° 10' N. He found the Sea open here as early as May the following year. In the spring of 1853 an excursion of above 1000 miles in length was made from the ship, in which numberless difficulties were surmounted, but no discovery made worthy of particular notice. Commander Richardson and a party had simultaneously with this, made a journey southward, and fallen in with despatches expected from Captain Pullen. During his absence he met with an Officer from the ships of Captain Kellet who announced to them the tidings of the discovery of Captain McClure and his people, Capt. Belcher, proceeded on a second journey in June, when he had the fortune to meet Captain Pullen from the *North Star*.

The *Advance*, Captain Kellet, and *Intrepid* screw Steamer, Commander McClintock, had accompanied Sir E. Belcher as far as Beechy Island, and then pushed to the westward, with a view of penetrating Barrow's Straits and reaching Melville Island. They parted company on the 9th August 1852, and got into winter quarters in September. Here they remained fast in the ice till 18th August 1853, when they were liberated by a storm.

So soon as the season permitted, sledge expeditions were undertaken in opposite directions by Captain McClintock, and Lieutenant Meecham, the former officer accomplishing a detour of 117 miles in 106 days. On the April 1853 a great exploring expedition started from the ships, Captain Kellet for a short distance accompanying it. Captains McClintock and Houston

with two other Officers, pushed northward; Lieutenant Meecham of the, *Investigator*, journeyed westward.

I have already mentioned the departure in January 1850 of the *Investigator* and *Enterprise*, under Captains McClure and Collinson, (p. 35) the former being first despatched under Sir James Ross—these vessels having been two years in the Icy Seas without being heard of, and being the last to return home I have hitherto confined myself to a notice of their departure, in order to be enabled to give a continuous narrative of their proceedings. The vessels having rounded Cape Horn, passed the Auletian Islands in long. 172° 30' W The *Investigator* entered Bhering's Straits on the 27th July and anchored in Kotzebue Sound. Though the *Enterprise* left the Sandwich Islands some days before the *Investigator*, it was found impossible to penetrate the ice, and. Captain Collinson was compelled to return and winter at Hongkong.

Capt. McClure dashed into the ice in bold disobedience of the orders of Capt. Kellet, of the *Herald*, the senior officer of the station, and who signalled his recall. By one of those singular coincidences, with which these Polar adventures abound, Lieut. Pim, who was the last to see the commander of the *Investigator*, on the west side of America, was the first to meet him on the east just three years afterwards. The *Investigator* rounded Point Barrow at the north-eastern extremity of Bhering's Straits on the 5th August; and keeping close along shore—passed the north of the Colville Jones Island, where he held some communication with the Natives; they were opposite the mouth of the McKenzie river on the 24th; passed Cape Parry on the 6th September, and were at this time close to the field of the researches of Dr. Rae in 1851. The *Investigator* next pushed her way through Prince of Wales Strait, as they termed it, dividing Baring Island from Prince Albert Land. They were now pursuing a course right for Melville Strait, and in hopes of making the North-west Passage in a single season, when on the 11th September, five weeks after they had entered the ice, their progress was arrested, and the ship frozen in. The winter was spent in exploring the dreary regions around, and it was not till the 11th July 1851 that the ice opened and the vessel was released. They were now in lat. 73° 14' N., long. 115 32' W., and it was resolved to retrace their steps through the channel, and endeavour to round the N. W. end of the island. Everything went well with them till the 24th September, when they were once more frozen in, and there, so far as is known, their ship remains till this day. In April 1852 a party from the *Investigator* crossed the ice to Melville Island. It consisted of Captain McClure, Mr. Conart, and six others. They deposited a paper under a cairn, giving an account of their late adventures and present position—it concluded with the following sentences, furnishing a fearful idea of the perils of arctic navigation, a noble one of the coolness and courage with which they were met :—

"It is my intention," he says, "if possible" to return to England this season (1852), touching at Melville Island and Port Leopold; but should we not be again heard of, in all probability we shall have been carried into the Polar pack, or to the westward of Melville Island,—in either of which events, to attempt to send succour would only be to increase the evil, as any ship that enters the Polar pack must be inevitably crushed. Therefore, a depot of provisions or a ship at Winter Harbour is the best and only certainty for the safety of the surviving crew."

The next year passed over their heads heavily, though without any relaxation of their exertions. The summer of 1852 was short, a cheerless winter set in August, and the thermometer by the new year had been at 62° below the freezing point. They had now for two years been on short allowances, the amount of their rations were every month being diminished and scurvy had begun to make its appearance amongst the men. Their voyage had become bootless—their investigations were hopeless, and almost without aim. The ship had now been for twenty months fast as a rock amongst the ice, and there seemed no chance of her release. Despondency, worse than the disease it begat, or fostered, was now gaining ground amongst men left alone in the fearful solitudes of the Polar Seas, to perish of starvation, as it seemed most likely Franklin and his people had perished, their fate a mystery for future ages. In April 1853 counsel was taken as to what under these unhappy circumstances should be done. Volunteers being asked for, twenty men were all that were willing to abide for another season by the ship, and there seemed no course left but her immediate abandonment while as yet the summer was before them. They proposed to cross the ice to the eastward, in hopes of reaching Melville Island, and so pressing on to take the chance of any shelter that might present, or ship that might be met in with—any risk or exertion was preferable to that of perishing in the terrible prison house to which they had now for three years been confined. They were busy with the arrangements requisite for carrying these plans into effect when deliverance they little dreamt of was found to be at hand. Some of the explorations of parties from Captain Kellet's ships have already been made mention of. In March 1853 one of the parties were fortunate enough to discover the despatch already adverted to, and brought it with delight on board. Lieutenant Pim pushed on to the northward and westward in the direction of the Bay of Mercy, to ascertain whether or not the *Investigator* still lay fast where she had been the year before. The journey was successfully performed and with a celerity inspired by the conviction that they were the messengers of deliverence to one of the long missing parties of their men.

Darkness, gloom, disease and despondency were continuing to gather round the *Investigator* as her people prepared to abandon their ship, now

becoming dear to them as she was about to be relinquished and they were getting ready to commence an enterprise of peril, perplexity and doubt. At 9 A.M. on the 19th April, to the astonishment of all, the look-out man, whose office had so long been a sinecure, intimated that persons were approaching, from the westward, when a party rushed out to meet and assist them. McClure and his first Lieutenant were pushing on over the floe, when, seeing some one approaching them as fast as possible they supposed him chased by a bear. Dr. Domville had outstripped his Commander, and was the first to salute the stranger. As he approached he waved his hands in the air and shouted. They were too far off to hear him, and even when he reached them he was not at first recognised. When he announced himself as "Pim, *Herald*," the officer that had been last seen when the *Investigator* was ordered by Captain Kellett to return, the first feeling was that of bewilderment, when delight and exultation succeeded to despair. The single hatch of the ice-bound ship was literally choked by the crew in their efforts to get a glance at their deliverers. A second party from the *Resolute* soon followed that of Lieutenant Pim. The Surgeon was sent to ascertain the health of the men, when it at once became obvious that it would be on the last degree inexpedient for them longer to remain where they were. They crossed the ice on sledges, and by the middle of June the whole of them were safely on board the *Resolute*, then in communication with Sir E. Belcher on the north, and Captain Pullen, at Beechy Island, on the east. Thitherward the most feeble of the men were forwarded, and they continued on board the *North Star* till joined a twelvemonths afterwards by the whole of their comrades preparatory for their final embarkation for England.

In March 1854 Lieutenant Meecham made a long excursion to the south-west, and discovered traces of Capt. Collinson, who had in 1851 followed pretty nearly in the track Captain McClure had pursued the previous year; but found himself compelled to return from the mouth of Prince of Wales Straits.

One great end of the expedition, the rescue of McClure and his crew, had now been accomplished, and the *Phœnix*, which had carried the tidings home the previous year, was expected to return with provisions and instructions as to future proceedings. As there seemed little hope of the release for an indefinite period of time of the vessels, which had for nearly two years been fixed immoveably, and everything in the way of investigation by expeditions over the ice having been accomplished, Sir E. Belcher issued orders in April that all the officers and men abandoning their ships should proceed to the rendezvous at Beechy Island and there await the steamer expected in July—a period of the season when no delay was permitted. Sir Edward himself and his people remained with the *Assistance* and *Pioneer*, which were scarcely forty

miles to the northward, till the beginning of August, only abandoning the vessels as the autum approached, and they believed the *Phœnix* to be at hand.

The officers and crews of the *Resolute* and *Intrepid* had abandoned their ships in the middle of May. Captain McClure and his people had been on board of the former vessel since June 1853. They proceeded together as directed, and reached their destination about the middle of June 1854, without accident, and were cordially welcomed on board the *North Star*.

In the beginning of July 1852 Captain Inglefield started with the screw Steamer *Isabella* of thirty horse-power, and 149 tons, the property of Lady Franklin, and the vessel shortly before destined for Bherring's Straits, under Captain Beatson. The steamer was prepared by Lady Franklin, to be considered as his property, and all the charges of the voyage were to be met out of his pocket. She was equipped and provisioned for a five years' sojourn in the Arctic Regions. Captain Inglefield proposed proceeding up Baffin's Bay as far as Smith's or Jone's Sound if possible, returning down along the western shore of the Bay, and along the coast of Labrador. He left Upernavick in Greenland, on the 10th August, taking dogs with him for the use of sledges, and then passed on towards Cape York, steaming through that archipelago of islands in the midst of innumerable icebergs. On the 20th August he reached Cape Athol, and visited the spot where Franklin and his crew were asserted by Adam Beck to have been murdered. The only traces that could be discovered of a visit from Europeans was a rag of cloth, a piece of rope, and the hoop of a cask—to all appearance left the previous year by the *North Star*; and he came to the conclusion that the story of Beck was a fable. Though starting three weeks later than the expedition of the preceding year, he reached a higher latitude (78° 35') than had been attained by previous voyagers. He was able to lay down 600 miles of coast line wholly new to us, and ascertained that Whale Sound was an opening, in all likelihood into the Arctic Ocean, rendering Greenland an island. Here he found himself in a great sea, only partially encumbered with ice, and the entrance to which was thirty-five miles across. As he was about to enter this in the hope of reaching Bhering's Straits, he was forced back by a storm. On the 1st September he sailed from Jone's Sound, and reached Beechy Island on the 7th. He now proceeded with his explorations on the western shores of Baffin's Bay, when he was driven over to the east by the ice and currents. Near Disco Island he encountered a series of violent gales, and having failed to reach the quarters where he intended to winter, started on his return on the 14th October, reaching Peterhead exactly four months from the time he had passed it northwards, but without any information as to the missing expedition, and without having communicated with any one during the voyage.

In June 1853 again Captain Inglefield was despatched in command of the *Phœnix* steamer with provisions for Sir E. Belcher. Lieutenant Bellot, who had accompanied Lieutenant Kennedy in the *Prince Albert* from Aberdeen in 1852, and rescued that officer from the ice, volunteered his services on board the *Phœnix*. He carried with him a large collection of magnetical instruments, Captain Inglefield himself being an eminent magnetican and first rate mechanic, and much was expected in this division of research. He was accompanied by the *Bredalbane* transport, afterwards nipped and lost amongst the ice. From the enormous quantity of ice met in with, and the delay occasioned in towing the *Bredalbane*, it was the 8th August before Beechy Head was attained. The condition of the ice was such as to render it impossible either to land the stores or to reach Sir E. Belcher, with the ships, and Captain Inglefield himself leaving the duplicate despatches for that officer with Captain Pullen of the *North Star* resolved to go in quest of him overland with the originals. He started with a whale boat and a month's provisions on the 10th August. On the third day of their journey they were compelled to return from the openness of the water. They took five days to Beechy Island, having traversed 120 miles during their absence. In a second attempt to convey the despatches, Lieutenant Bellot was precipitated from an iceberg, on which he had drifted from the shore, and drowned. In May the people of the *North Star* learned with delight from Captain Kellett the safety of Captain McClure and particulars of the voyage of the *Enterprise*.

Captain Pullen, from the *North Star* had meanwhile succeeded in communicating with Belcher, so the end was equally served, and Captain Inglefield resolved on returning to England, his instructions precluding him from remaining through the winter: he left on the 24th August, and reached Thurso, in the North of Scotland, on the 4th October, bringing with him the joyous tidings of the discovery of the North-West passage.

In 1854 the ships were moved about half a mile by blasting, but this was all that could be effected. In the month of August of that year, the pack of ice betwixt the ship, and the nearest open water was computed at from twenty to thirty miles. On the 24th the *Phœnix* was in communication with the *Resolute* and *Advance*, and the ship were next day abandoned.

On the 6th of May 1854 Captain Inglefield once more started in command of the screw steamer *Phœnix*, with the tenders *Talbot* and *Diligence*, to carry provisions and instructions to Captain Belcher, and to assist in the search. Great latitude of discretion was allowed him. If the crews of the *Enterprise* and *Investigator* (Collinson and McClure) should have reached Banks Land, they were to abandon their ships, make, if possible, for Beechy Island, and return for England; if these officers and their men, should already have been

extricated, and Captain Kellet with the *Resolute* and *Intrepid* had returned from Melville Island, further search was to be given up, and the whole of the expeditions were to return home; if Captain Kellet was found unable to move, then his ships were to be abandoned, and he and his crews to return.

The *Phœnix* reached Disco on the 4th July. Though the accounts received from Upernavick of the return of a whaler unable to force a passage through Melville Bay, Captain Inglefield resolved to make the attempt. He was fortunate in the course of his progress. On the 29th they reached the seam of coal discovered by themselves the previous year, and took seventy tons on board. They were driven to sea by a storm. Failing to penetrate the ice in this direction after many fruitless attempts, they returned to Livelez in Greenland, where they coaled in full. Leaving on the 7th August, they took the pack abreast of Upernavick, 72° 30' N. For ten days they pushed their tedious way, blasting and boring through the ice, especially retarded by the freezing of the sea around them over night. By the 19th they had reached the nearest water. Near Cape Castlereigh they found the remains of the stores deposited by the *Norh Star* in 1850—the bulk of the provisions had been carried away by the Esquimaux, and whole of the cases burst and casks stove in. Part of the flour was serviceable, and so much of it as could be made use of was taken on board. In six hours from the time of anchoring they stood out to sea, Captain Inglefield landing at Cape Warrender to inspect a cairn he had constructed the previous year. Soon after this both vessels grounded, and remained fast for twelve hours, but on their stores being placed in the boats were got off without injury. They reached Beechy Island on the 25th, having as they neared observed the *North Star* looming through the fog. The crews of all the vessels were immediately taken on board, and sailed for England next day, where they arrived on the 6th October: nothing worthy of notice occurring during the voyage. The Commanders were, according to the rules of the service, tried on their arrival for the loss of their ships. They were all fully and honorably acquitted save Sir E. Belcher, who was acquitted fully but not honorably, though it is by no means obvious why he should have been made an exception.

The *Plover*, which since 1848 had remained stationed at Port Barrow, 600 miles north of Bhering's Straits, as a provision ship, and had received supplies from the *Herald* the following year, now stood in need of further assistance; and the *Rattlesnake*, Captain Trollope, was ordered to get in readiness. She sailed in February, and was to be attended by a steamer to Cape Horn, and towed through Magellan Straits. This amount of assistance having been considered altogether inadequate, Lady Franklin, who had just received a donation of £1,600 from Van Dieman's Land and from the Colo-

nies, in grateful remembrance of her husband when Governor, had the *Isabella*, her own steamer, once more fitted up, and placed in command of Lieutenant Kennedy, who in 1851 had commanded the *Prince Albert*, from Aberdeen, on her second voyage of discovery. Subscriptions now came pouring in apace : the Admiralty lent every assistance, and the *Isabella*, towed as far as the Isle of Wight, left England on the 8th of April, fully provided for a two years' sojourn in the Icy Sea. She crossed the line southward on the 12th May, having proceeded thus far under sail, and reached her destination in safety. The *Plover* and she were released from further duty, and returned to England on the appearance of the *Enterprise* in October 1854,—thus clearing the Northern Pacific just as the Northern Atlantic had about the same time been cleared of Arctic expeditions. By a singular coincidence within the same fornight that Captain Inglefield reached England, and Captain Collinson arrived in the Anglo-Chinese waters, Dr. Rae, returned from Canada, bringing accounts of the melancholy fate of those who had for the preceding five years occupied so large a share of the interests of the civilized nations of the world.

In 1853 Mr. Grennel resolved to equip a vessel at his own expense, and to entrust the charge of it to Lieutenant (late Dr.) Kane, who had in 1850 accompaned Lieutenant De Haven as medical officer, and subsequently published an account of that most singular voyage. The *Advance*, 144 tons, one of the brigs despatched in 1850, was again selected. She left New York on the 31st May. The search for Franklin was the first great object of the expedition, but as this was not incompatible with other pursuits, Lieutenant Kane was provided with a first rate set of magnetical and meteorological instruments, furnished by the Smithsonian Institution, and a distingnished astronomer and naturalist accompanied him.

They reached Baffin's Bay on their way south in July 1854, having not up to this date heard anything of the fate of any of the Arctic voyagers, and continued their explorations till the end of the year.

Having thus brought this portion of the narrative to a close, the proceedings of Captain Collinson in the *Research*, the consort of the *Investigator* as far as Bhering's Straits, come next to be considered, reserving to the end the narrative of Dr. Rae, the last of all for the denouement of this strange eventful history.

It has been already mentioned that this officer accompanied the *Investigator*, as far as Bhering's Straits in 1850, but found the ice impenetrable, and so was compelled to return and winter at Hongkong. Traces of him had, as already detailed, been discovered as far east as Prince

of Wales Inlet, (see ante p. 43) whither he had pursued the track of Captain McClure at the interval of a twelve month, and then found himself compelled to return. The account of the voyage is so concisely narrated in the *China Mail* of the 2nd November that I give it in slightly altered form below :—

" After completing provisions and stores, we sailed from Hongkong on the 2nd April 1851, and reached the Bonin Islands on the 28th, sailed again on May 6th, entered Behring's sea on the 23rd, and fell in with the whaling fleet at the edge of the ice, in latitude 60° N. longitude 179 W., on the 31st. Taking the pack, we pushed through the ice, saw Cape Behrings on June 11th, and got into land water under Cape Tchutskoi on the 22nd. In crossing over to the American continent, we were again beset, and carried North of the Diomede Islands, arriving in Port Clarence on July 3rd. Here we communicated with the *Plover*. Sailing on the 10th, Point Hope was passed on the 15th, Icy Cape on the 18th ; and on the 20th, when off the Seahorse Islands, were caught in the back, and carried round Point Barrow on the 25th, but reached open water near Point Tangent on the 31st. Then pursuing our course between the American continent and the ice, we passed Point Manning on August 18th. Cape Parry was seen on the 26th, and the same evening land to the North. On closing it, a Strait was entered on the 29th, and on an Island were found a boat and some provisions deposited by the *Investigator*, which vessel it appeared had entered in the pack four miles N. E. of the depot. Pursuing our course, we reached the north end of the Strait on the 30th, when our progress easterly was blocked by field ice. Returning through the Prince of Wales Strait, we rounded Cape Erebus (the south point of Baring's Land) on September 2nd, and tracing the coast-line north, found a cask with information from the *Investigator* dated August 18th, 1851, in lat. 72 N long. 125·45 W. Continuing on to the northward, provisions were deposited on an Islet in lat. 72.55 N., long. 12.10 W., but finding no place sufficiently protected for winter quarters, we returned to the entrance of the Prince of Wales Strait, and wintered in a sound on Prince Albert's Land in lat. 71.35 N., long. 117.35 W.

In April, three travelling parties left, one tracing Prince Albert's Land southerly, found the coast trend to the eastward in lat. 70.39 N., in which direction it was followed to long. 112.35 W., whence the southern shore was seen, but no land to the eastward. Here a large party of natives were met, and on an islet in 70.34 N., and 115.20 W., a notice from the *Investigator's* travelling party last year was found. This party returned on May 30th, having been absent 48 days.

The other two parties passed through the Prince of Wales Strait together, then one followed the coast of Prince Albert's Land, which was found to trend southerly, eventually reaching lat. 72.44 N., long. 113.45 W., and returned to the ship after 52 days' absence. The other struck across for Melville Island, and coming upon rough ice impassable for the sleigh, left it and the tent in lat. 73.41 N., long. 115.15 W., and carrying their provisions on their backs, reached Cape Possession, whence some of the party travelled along the coast until they were within four miles of Point Hearne. They returned to the tent and sleigh after an absence of 14 days, but some of the crew suffering from frost-bites, did not reach the ship until June 28th, being absent 74 days.

The ship swung to her cable on the 19th of July, but the ice did not admit of our putting to sea until August 5th, and then we were detained in the vicinity until the first week in September. Following the coast line of Prince Albert's land southerly and easterly, its junction with Victoria and Wollaston was ascertained; we then entered the Dolphin and Union Strait, reached Cambridge Bay on 26th September, where our second winter was passed. In 68.50. N. we came upon old ice rendering the road impassable for sleighs, and compelling us to keep close to the coast line. A cairn in which was a notice deposited by Chief Factor Rae in 1851, in lat. 70.02 N., long. 101.18 W., gave us the first intimation that the ground we were upon had been already examined. The coast was then followed westerly as far as 70.13 N., and 101.50 W., and the party returned to the ship after an absence of forty-nine days.

The game became plentiful in the early part of June, and after the middle of July an abundance of excellent fish was obtained by the seine. The ice began to move on the 25th and enabled us to put to sea on the 5th of August, meeting with no obstruction from it until we reached the Coppermine River where the pack detained us seven days, and again off Cape Dalhousie, from whence to 140.0 W. we had a pretty clear sea. Here we were again beset, and carried back by a westerly wind as far as Point Kay. Effecting our escape on 9th September, we reached Point Manning, where the ice again proved too close to admit of our progress, but by taking advantage of occasional openings, we reached Camden Bay on the 14th, beyond which we were unable to get, and were finally frozen in on the 26th, in lat. 70.08 N., long. 145.29 W.

The ship reached Point Barrow on the 8th of August and picked up her boat, and fell in with five American whaling vessels on the 12th—it being three years and one month since we had any communication with civilized society; and obtained from them the gratifying intelligence that the *Investigator* had communicated with the Eastern expedition.

On the 22nd we arrived at Port Clarence, and found only the *Rattlesnake*, the *Plover* having sailed two days previously for Port Barrow, and passed us in a fog, while the *Trincomalee* had sailed the morning of our arrival for Vancouver Island.

Receiving a small quantity of provisions from the *Rattlesnake*, we started in the hope of overtaking the *Plover* and ensuring her return, while the *Rattlesnake* was despatched to San Francisco, in order to convey the news of our return with all speed to England.

We did not succeed in catching the *Plover*, but found her at anchor at Point Barrow on the 30th. Then both vessels returned to Port Clarence, whence the *Plover* proceeded to Valparaiso, and the *Enterprise* to Hongkong on the 16th October."

Dr. Rae's journey now alone remains to be disposed of. That indefatigable traveller, as already stated, left Liverpool for New York on the 23rd March 1854, to undertake his fourth journey along the shores of the Icy seas commenced since 1850. His account of proceedings is so clear and concise that I give his letter entire :—

"REPULSE BAY, JULY 19, 1854.

"During my journey over the ice and snows this spring, with the view of completing the survey of the west coast of Boothia, I met with Esquimaux in Pelly Bay, from one of whom I learnt that a party of 'white men' (Kabloonans) had

perished from want of food some distance to the westward, and not far beyond a large river containing many falls and rapids. Subsequently, further particulars were received and number of articles purchased, which places the fate of a portion if not of all, of the then survivors of Sir John Franklin's long-lost party beyond a doubt—a fate as terrible as the imagination can conceive. The subtance of the information obtained at various times and from various sources was as follows :—

"In the spring, four winters (spring 1850), a party of 'white men,' amounting to about 40, were seen travelling southward over the ice and dragging a boat with them by some Esquimaux, who were killing seals near the north shore of King William's Land, which is a large island. None of the party could speak the Esquimaux language intelligibly, but by signs the natives where made to understand that their ship, or ships, had been crushed by ice, and that they were now going to where they expected to find deer to shoot. From the appearence of the men, all of whom except one officer looked thin they were then supposed to be getting short of provisions, and they purchased a small seal from the natives. At a later date the same season, but previously to the breaking up of the ice, the bodies of some 30 persons were discovered on the continent, and five on an island near it, about a long day's journey to the N. W. of a large stream, which can be no other than Back's Great Fish River (named by the Esquimaux *Oot-ko-hi-ca-lik*), as its description and that of the low shore in the neighbourhood of Point Ogle and Montreal Island agree exactly with that of Sir George Back. Some of the bodies had been buried (probably those of the first victims of famine) ; some were in a tent or tents ; others under the boat, which had been turned over to form a shelter, and several lay scattered about in different directions. Of those found on the island one was supposed to have been an officer, as he had a telescope strapped over his shoulders and his double-barrel gun lay underneath him. From the mutilated state of many of the corpses and the contents too of the kettles, it is evident that our wretched countrymen had been driven to the last resource—cannibalism—as a means of prolonging existence. There appeared to have been an abundant stock of ammunition, as the powder was emptied in a heap on the ground by the natives out of the kegs or cases containing it ; and a quantity of ball and shot was found below high-water mark, having probably been left on the ice close to the beach. There must have been a number of watches, compasses, telescopes, guns (several double-barrelled), &c., all of which appear to have been broken up, as I saw pieces of these different articles with the Esquimaux, and together with some silver spoons and forks I purchased many as I could get. A list of the most important of these I enclose, with a rough sketch of the crests and initials on the forks and spoons. The articles themselves shall be handed over to the Secretary of the Honorable Hudson's Bay Company on my arrival in London. None of the Esquimaux with whom I conversed had seen the 'whites,' nor had they ever been at the place where the bodies were found, but had their information from those who had been there and who had seen the party when travelling.

"JOHN RAE, C. F.

"Commanding Hudson's Bay Company's Artic Expedition."

Thus ended a series of enterprises of the most heroic character, thirty in number, pursued almost without interruption over a period of thirty-seven years, in which many of the most noble qualities of the British seaman had been displayed. Long before 1818 the question had been settled as to the utter worthlessness of the North-West Passage for commercial purposes ; and the vast amount of money expended and daring enterprise displayed was so entirely in the cause of geographical discovery and physical research.

I conclude with a short chronological notice, which may help to assist the

memory and keep the whole details before the mind: a reference to a good recent map will make the subject plain.

1818.—*Hecla* and *Griper*. Captain John Ross and Lieutenant Parry. Returned same year.

1818.—*Dorothea* and *Trent*, Buchanan and Franklin. Proceeded direct for the Polar Sea; reached Lat. 80° 32′, and returned the same year.

1819.—*Hecla* and *Fury*. Parry and Lyon. Returned in October, 1820.

1820.—Franklin and Richardson, overland journey by the McKenzie river. Returned in 1822.

1821.—*Hecla* and *Fury*. Parry and Hopner. Returned in October 1823.

1824.—*Hecla* and *Fury*. Parry and Hopner. *Fury* lost—*Hecla* returned 1825.

1825.—Franklin and Richardson start on their second overland expedition. Returned in 1828.

1825.—The *Blossom*, Captain Beechy, starts for Behring's Straits. Pursues a magnificent course of investigation in the Pacific and China Seas. Spends the Summers of 1826-27 north of Behring's Straits.

1827.—Captain Parry attempts an Expedition from Norway, over the ice. Reaches 82° 40′, and returns in 1828.

1829 —Captain Sir J. Ross starts in the *Victory*, a private ship. Returns in October 1833.

1836 —*Terror*. Captain Back. Starts for Lancaster Sound. Returned in 1837.—Overland journey by Messrs. Simson and Deare to Arctic Ocean.

1839.—Second expedition by same parties.

1845.—*Erebus* and *Terror*. Franklin and Crozier. Started in May. Last heard from in August northwest of Greenland. No tidings since been received of them.

1848.— Sir John Richardson and Dr. Rae undertake an overland journey in quest of Franklin. Proceeded as far as the Great Bear Lake, and thence by the McKenzie River to the Sea. Returned in 1849.

1848.—*Enterprize* and *Investigator*. Sir James Ross. Proceeded as far as Fury Point, and wintered. Returned in 1849. Left in the ice August 1853.

1848.—*Plover* dispatched. In August 1849 she reached Lat. 72° 51′, long. 163° 48′.

1848.—*Herold* sent out with stores to *Plover*. Returned in December 1849.

1849.—*North Star* dispatched to aid Sir J Ross, but missed him. Returned in October 1851.

1850.—*Enterprize* and *Investigator*. Commanders Collinson and McClure. Sailed 15th January for Cape Horn and Sandwich Islands, for Behring's Straits. Left in the ice 1853, officers and crews returned in Octoer 1854.

1850.—*Advance* and *Research*, under Lieutenant DeHaven, leave New York for Siberia and Nova Zembla. Penetrated Wellington Strait to 75°.

1850.—*Resolute* and *Assistance*. Captain Austin. Sailed in April. Captain Penny with the *Lady Franklin* and *Sophia* dispatched in concert. Returned September 1851.

1850.—The *Prince Albert*, Captain Forsyth. Started from Aberdeen. She communicated with Captain Austin, and returned in October, never having had her anchor down during the intervals.

1851.—The *Prince Albert*, Captain Kennedy, started with Lieutenant Bellot on board, a second time from Aberdeen, and returned in October 1852. Her Commander discovered the stores at Fury Point in perfect order. He made an excursion overland and on the ice of eleven hundred miles, being absent from his ship ninety-three days.

1852.—April—Sir Edward Belcher, with five ships, dispatched from Beechey Island, where the *North Star* store ship was to remain a depot. A sailing vessel and steamer, the the *Assistance* and *Pioneer*, to penetrate Wellington Channel in quest of Sir John Franklin, a similar force, the *Resolute* and *Intrepid*, Captains Kitto and Pullen, to make for Melvill Island to endeavour to obtain tidings of Captains Collinson and McClure.

1852.—June—The Hudson's Bay Company resolve to dispatch an expedition over the ice, under command of Dr. Rae.

1852.—July—Captain Inglefield, with the *Isabella* Screw Steamer, 140 tons, fitted out by Lady Franklin, leaves for Baffin's Bay—returned in November, having in the short space of four months seached Davis's Straits from England, passed Murchison's Straits, penetrated 140 miles further North in Smiths' Sound than any previous Navigator sailed up Jones' Sound, penetrated Barrow's Strait, and communicated with the Squadron of Sir E. Belcher.

1852.—July—Commander McGuire starts from Port Clarence, and proceeds by the Eastern passage through Behring's Straits, reaches Point Barrow on the 23rd of August and returns.

1853.—March—The Screw Steamer *Isabella* dispatched for Behring's Straits under command of Lieutenant Kennedy. In April Dr. Rae leaves Liverpool for New York on his way to Lake Superior, and so to Northern Canada, where he is successful in obtaining tidings of the missing voyagers.

1853.—May 31.—A ship fitted out from New York entirely at the expense of Mr. Grennel, an American Merchant, with a splendid collection of Philosophical instruments, with instructions to endeavor to penetrate through Baffins' Bay into the supposed Polar Basin.

1853.—June.—The *Phœnix* Steamer, under Captain Inglefield, dispatched with stores for Sir E. Belcher's squadron, and learns from Captain Pullen, of the *North Star*, tidings of McClure's ship, which had been fast in the ice for two years to the North of Behring's Island, and has thus achieved the discovery of the North West passage. They had been out on a long excursion on the ice, and met an excursion party from Captain Kellet's ship the *Advance*, to Barrow's Straits. The *Phœnix* returned to England on the 8th of October.

1854.—May.—Captain Inglefield again proceeded in quest of Sir E. Belcher, and returns on the 6th of October with the officers and crews of all the ships, four of the vessels themselves having been left in the ice.

1854.—October 14.—Captain Collinson with the crew of the *Investigator* arrive at Hongkong. October 19.—Dr. Rae reaches England with the account of the fate of Franklin and his companions, and the Admiralty resolve to send out two other expeditions to explore Upper Canada in hopes of recovering the manuscripts of Franklin.

For many years a reward of £20,000 had been offered by Parliament for the discovery of the North-West Passage. In 1818 the amount was modified to the sum of £5,000 to the first person who should reach the 110th degree of West longitude, £5000 to him who should attain 120, and £5000 to any one getting ten degrees further on. Under this provision Sir Edward Parry received one of these sums for having in 1823 passed the first of the meridian just set down. In 1828 the Act was repealed, and the prizes no longer continued open. A committee appointed by Parliament in 1855 to consider the whole question, recommended that irrespective of this £5000 should be assigned to Captain McClure personally, and a second £5000 to the officers and crew of his ship. The other officers who had shared in these most daring enterprises were requited with an almost unbounded allowance of praise—neither honors nor rewards such as those bestowed on parties present in a campaign in which victory has been won, were vouchsafed to a band of heroes who in the cause at once of science and of humanity had for years braved dangers, defied labour, and surmounted difficulties such as the arctic voyager alone can comprehend.

The first division of the preceding memoir is compressed from the work of Sir John Barrow; the latter portion is an abridgement of the notices from time to time published in the *Athenæum*, or which have appeared in the newspapers of the day—my task has been that of condenser or compiler merely.

ART. III.—*Brief Observations, forming an Appendix to the Map of Baghdad.* By FELIX JONES, Commander I. N., and Surveyor in Mesopotamia.

THE present Map represents the ground plan of a city once as celebrated as any in the Universe. A hopeless decay during six centuries, in which it has been contended for and held by many conquerors, has yet failed in ruining it altogether, though its attenuated state at the present day serves to show the original vigour of its constitution, when founded by Al Mansur, eleven centuries ago. For five hundred years it was the abode of the Abbasside Khalifs, and with more or less interruption the seat of Empire of the World.

To the antiquarian and general scholar the site possesses various attractions, for, degraded as it is, Baghdad is still the representative of those great capitals which flourished in antiquity, and which are intimately blended with sacred and profane writings, as well as connected with the early spread of Christianity itself. After the total destruction of Seleucia and Ctesiphon, where the episcopal chairs had been established by the first missionary fathers, the Eastern Metropolitians have been invested here, and the title of Bishop of Babylon still pertains to the Archiepiscopal See, at present more respected in the title than honored in any thing else ; and, though the Khalif Al Mansur is named by all the writers as the founder of Baghdad, there is little doubt, from existing remains, but that a Babylonian city occupied the spot long before the establishment of the Khalifate on the soil.

I shall not stop to dwell on its history, nor detail the motives of Mansur for fixing on a new locality to establish his "*House*," such indeed was the custom among barbarian conquerors, from antiquity to the present time. It appears that the western side of the Tigris was the chosen site for the original Baghdad, the larger position of the town now to the east of the river, having risen from a military position and enlarged afterwards to suit the growing extent of the population as individual families settled from nomade life, or as emigrants from more distant places. The new city was added to also by the remnants still lingering around the ruins of Ctesiphon and Seleucia, and with captives and others—either brought or invited, from lands over which the early Khalifs extended their arms—the city and tracts around soon become a highly populated district. All writers enlarge upon the masses that comprised its population in its more prosperous periods, though there is great discrepancy in enumeration. At the funeral of Ibn Hanbal,* a much venerated Mahomedan sage, who died at Baghdad in 241 A. H. We are told eight hundred thou-

* Refer to the annals of Abulfeda and D' Herbelol's history of the Mahomedans.

sand men and sixty thousand women formed a procession to his grave, and that near twenty thousand infidels became converts to Mahomedanism on the day of his death. With every allowance for exaggeration, both in respect to this statement and to the number of three hundred and sixty baths mentioned as being requisite to the purification of its inhabitants by other authors,* we must admit the fact of its multitudes in a great degree ; especially as the deserted tracts, covered as they are with the broken remains of edifices and canals, speak in favour of its truth. The myriads that were slain too after the sack of Baghdad by Halaku in A. H. 656, and by Timour-lenk (Tamerlane) in A. H. 803, incredible as the accounts are, shew how prolific the numbers were, the former by the smallest accounts having massacred in cold blood three hundred thousand of the defenders of the city, while the latter erected beyond the gates, as a trophy of his prowess, a couple of pyramids which were constructed of the heads of ninety thousand of its most influential people. At the present time the census is about sixty thousand, having in the last thirty years dwindled from one hundred thousand to this amount from various causes, the chiefs of which being a great plague and inundation in 1831, and minor ones in the form of mal-administration by successive rapacious governors.

Designed in 145 A. H. the city soon rose to magnificence, and, perhaps, attained to its greatest splendour during the reigns of Haroun-ar-Rashid and his immediate successors. The wealth of the world appears indeed at one time to have been centred on this spot. Manufactures, commerce, sciences, arts, all flourished under the fostering care of many of the Khalifs, particularly under that of Al Mamun, in whose reign the first great arc of the meridian was measured in Mesopotamia—colleges and schools were founded and endowed, and the liberal and abstruse sciences were cultivated with enthusiasm, and success. Its artisans were celebrated also in the age they lived in, so much so, that an ingenious clepsejdra, or water clock, originally devised in Greece or Rome,† issued from its workshops, and was deemed, as we have read in the history of some one of the Khalifs, a present worthy of the acceptance of a King of France. The splendour of the court at Baghdad in those days excelled anything that was known. It is true it was a display of barbaric magnificence, but the usages of the age must be considered in contemplating it. In the annals of Abulfeda, we are treated with the programme of the pomp exhibited in the court of the Khalif at Moktadar on the reception of an Ambassador from Greece. The army was drawn up to the number of one hundred and sixty thousand men. The Khalif himself, surrounded by his chief ministers and favourite slaves, covered with gold and jewels, resembled a

* See the Tarikhi Baghdad and a work called the Kharidet-al-Ajaib on this subject.

† I have heard this questioned, and the honor of the invention accorded to R[illegible]

planet amid a galaxy of stars. Eunuchs, black and white, with inferior officers, to the amount of eight thousand, served as a foil to these gems. Silk and gold embroidered tapestry, numbering thirty-eight thousand pieces, ornamented the palace walls, and on a curious tree of gold and silver were perched a variety of birds, whose movements and notes were regulated by machinery. Twenty-two thousand carpets covered the floors, and a variety of vessels, each splendidly decorated, floated on the broad stream of the Tigris, before the windows of the palace, while a hundred lions in charge of their keepers lent a contrast to the glittering scene.* Its institutions boasted of authors, physicians and philosophers, and in their libraries were stored a vast number of books, all manuscripts, for printing was not then invented. We may judge of their amount, when it is related, that a doctor declined the invitation of a Sultan of Bokhara, because his books alone would have required four hundred camels for their transport.

Money too must have been alike plentiful in its treasuries. The founder of Baghdad, Al Mansur, is reported to have left at his death about thirty millions sterling. His son expended three millions in a single pilgrimage to Mecca, and we read of a Vizier having founded a college at a charge of two hundred thousand pieces of gold, endowing it at the same time with an annual sum equivalent to seven thousand pounds. What then must have been the revenue which admitted of such a drain on the coffers of Baghdad? We learn from a financial document, drawn up by one Ahmed-ibn-Mahomed during the reign of the Khalif Al Mamun, that from the various tributes received in specie and kind it amounted to about fifty-six millions sterling. As a dependancy of Turkey in 1854 its revenue is under three hundred and fifty thousand pounds.

Nothing strikes more forcibly than comparisons, and here is one exhibiting a lamentable contrast between splendour and poverty. An abundance of riches acquired by the strong arm and abstemious habits of the early Arab conquerors soon led to luxury and effeminacy. The hand of Haroun-ar-Rashid which subscribed the letter to the Emperor Nicepharus calling him "a Roman dog" was capable of action in support of the insulting speech, but the inflated language of the later Khalifs derived no weight from the listless character of their lives. Isolated from their subjects by pretended sanctity of person, they passed their days in the seclusion of the "Harem," while factions were struggling in the city, abetted by traitors beyond the walls and rebellions in the provinces at a distance. Thus the Seljuck Princes diminished the authority of the Khalifs and paved the way for the advance of the Tartar hordes under

* The glowing descriptions in the Arabian Nights of the splendor of the Court and other scenes in Baghdad are familiar to us all. They are doubtless much exaggerated, but still impress us with an idea of display in accordance with the wealth of its people.

Halaku at a subsequent date. His victory sealed the fate of Baghdad and the Khalifate in A. H. 656, and Al Mostasem, the last of the long dynasty of the Abbassides—he whose vanity led him to conceal himself from the gaze of his subjects by a veil—was dragged through the city, sewn up in a felt, at the heels of the enemy's horse. It became subsequently the prey of various parties, until Timour-lenk made his famous descents upon it in 795 and 803 A. H., on both which occasions he took it but restored it, after the massacre of vast numbers, to Sultan Ahmed, who was, however, chased from it again by Miram Shah the son of Timour-lenk. Then the factions or tribes denominated Ak-Koyunlee and Kara Koyunder or "white and black sheep" held it successively until 914 A. H., when the city was seized by Shah Ismail Sufi, the Persian king, but so renowned a spot could not be left without contention, and we accordingly find both Persians and Turks struggling for it with various successes in many bloody wars of the day. The Turkish Sultan Suliman I. at length acquired possession in 941 A. H., 1854 A. D., from the Persians ; but it was recovered by them in the reign of Shah Abbas the Great, and remained a dependancy of that Kingdom until Murad IV. besieged it in person and made himself master of it in A. D. 1638. The Turks have held Baghdad since that time, though Nadir Shah attempted to capture it in the first part of the last, as did Mahomed Ali Mirza, Prince of Kermanshah, in the beginning of the present century. No wonder, then, if we see only the skeleton of its former self—especially when we consider that inward corruption has materially aided in the destruction of the carcase, and notwithstanding its whitening bones, there are yet vigilant hawks abroad.

In the pages of Niebhur, Buckingham, and Trayer, the curious will find ample descriptions of its condition both political and social in the past and present centuries. I shall, therefore, confine myself to the facts of its bearing now but a thread-bare resemblance to the impoverished pictures they have drawn ; for a general but a certain deterioration since their day is apparent in the city as well as in the provinces of Irak, of which it is the capital. By some singular fatuity it has received and still holds the title of Dar-as-Sellam, equivalent to our "abode of peace," others entitle it Medineht-al-Khalafa, the city of the Khalifs, in addition to its name of Baghdad.

Many vague tales which I will not transcribe are related by oriental writers in the Tarikhi Baghdad and other works of the day, on the origin of this name ; but we learn that that part of the city west of the Tigris was known also as Kerkh, a name merely implying "a pleasant habitation," and that Rasafeh* was an extensive suburb of the city extending to Kilwatha, identical with the modern Gerareh. In its flourishing period under the Khalifs the suburbs and

* This was first peopled by Mehdi, the son and successor of Al Mansur.

gardens for miles around derived their water, though washed by the Tigris from the Great Nahrwan canal, a work originating in remote antiquity, but restored under the vigorous administration of the early Khalifs. I have given a full description of this great aqueduct in a former paper, which will be found in the Transactions of the Geographical Society of Bombay.

The enclosed area, within the present walls of Baghdad, contains seven hundred and thirty-seven acres, the eastern portion of the city extending over five hundred and ninety-one, and the western over one hundred and forty-six acres. The singular alignments of the walls will be best seen from the plan They are very irregular and seem to have been constructed on no systematic plan, but to have been drawn around the various groups of buildings as they then stood. I have not been able to learn in whose reign they were first designed; but powerful as the earlier Khalifs were, we may presume that no invasion was feared in a city whose monarchs governed from the Oxus to Gibraltar. The glory of Greece had set, and that of Rome was so declined as to offer but feeble and distant menace to those who had overran kingdoms, and whose hordes were yet united either for the dissemination of the faith, or for the punishment of infidels. The vast armies that acknoweldged and proclaimed the supremacy of the Khalif of Baghdad in every direction, were, indeed, sufficient guarantees for the safety of the " City of Peace;" and we may presume, therefore, that Baghdad, whatever inward defences it may have had against a turbulent towns people,* remained for a period ungirt by a wall. The excitement of conquest over discord prevailed among leaders who set themselves up in opposition to sovereign authority, particularly when the Khalifs no longer led in person, but revelling in sloth and effeminate pleasures wanted the energy to repel disorders both at home and abroad. From a fine Arabic inscription in relief on a scroll border around the tower of the Taliesh-manic gate, we gather that that portion of it at least was built in A. H. 618, at the beginning of the thirteenth century of Christ, by the Khalif Abul Abbas-an-Nasr-ed-din. This is a fine specimen of Saracenic brick work, and, if we except the holes made in it by Artillery during some sieges, it looks as fresh as if it were but a recent work. In all probability it is of later construction than many parts of the foundations of the wall, for they bear the impress of age, and exhibit moreover the open brick and mortar work peculiar to the older " Mosamehs."† The foundation of the Baghdad walls may, therefore, date from the third century of the Hejreh, when alarms were first experienced from

* Matasim Billah, the eighth Khalif, quitted Baghdad and made Samara into a capital, where he and a few of his successors resided for a time on account of the refractory disposition of the inhabitants.

† A name applied to substantial embankments of masonry, built principally as water defences, on which the fortifications are raised.

without.* The decline of the place is well marked on the face of them, for we observe all shades of patchwork during successive centuries even to the "wattle and dad" embankments hastily thrown up as stop-gaps where, to prevent smuggling, the authorities have been too poor to give a more substantial repair. It has ten round towers half enclosed within the outer wall, which, where they are situated, forms a semi-line around them. These are solid constructions of brick with embrasures and some few cannon on each Many of these are of large calibre, long and heavy, and fine specimens in copper and brass of the ornamented gems, such as were cast in the flourishing periods of the Turkish empire. Most of them were cast in Baghdad, which cannot now boast of a foundry capable of making a small ordinary cannon. There are some iron pieces of various nations, brought doubtless by the Tigris from Basreh, where they have been procured from foreign ships. Most of the pieces are sadly honey-combed, and their enormous vents shew they have had much use in their day. Little damage need be apprehended from them now, crippled as they are in carrige, some of them even lying on the platform without any at all. There is some talk of converting them into copper and brass money, but the difficulty is now to break them up for coining, and to remove them bodily with Baghdad men and appliances seems to be out of the question. Many date their construction from two centuries back. The wall itself rises from a fosse originally about eighteen feet deep to the same height above the plain beyond.

A strong embankment girts the ditch on the outside, and situated at irregular intervals between the round towers are buttresses or half bastions of equal dimensions to give strength to the escarpe or revetment of the wall, so well as to protect it by a flanking fire, being like the wall itself loopholed for musketry.

On the inside, this wall is exposed only for thirteen feet, the rest being concealed by a thick rampart of earth, which strengthens it and serves, at the same time, to protect the enciente from inundations of the rivers which fill the moat and press hard upon the fortifications. The wall affords some shelter to its defenders by being poorly arched somewhat in the form of casemates; over these is a road way a few feet broad, the top of the wall, which is embattled, acting as a parapet above it. Four gates, with solid bridges† over the ditch originally led to the plains beyond. Three only are now open, namely, the north-west one, or Bab-al-Moadhem; ‡ the south-east one, or Bab-as-Sherki; and the middle gate Bab-al-Wastani; the Babal Telism

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* In the Nushat-al-Qulub of Abdallah Mustafi we read of a wall of lime and kiln-burnt bricks, surrounded by a ditch, having been erected by Mustadhir Billah, the eighteenth Khalif, in about 300 A. H. or A. D 913.

† In execrable repair.

‡ Named thus from facing the village of Moadhem, the burial place of a popular Sunni lawgiver and saint, bearing that title which signifies "honored."

having been closed, according to custom, since the Sultan Murad IV. issued from it on his departure for Constantinople after capturing the city from the Persians. The circuit of the eastern fortifications, including the river face, is ten thousand six hundred yards, that of the west being five thousand eight hundred yards, making an entire length of sixteen thousand four hundred yards of wall, an extent of brick work equal to nine miles and two and a quarter furlongs nearly of English statute measure.* Such however is its state that it offers scarcely any impediment to a well appointed force, as a breach could be effected any where in a few minutes cannonade, and the numerical strength of the garrison and fighting population is so small as to be incapable of covering the defences if threatened in more points than one. On the river face the town is quite open, and with small steamers or gunboats, judiciously anchored so as to command the Sheriahs or landing places, an invading force might take possession of the place, either through the windows or balconies of the houses, or by a deliberate march through the open streets. The citadel offers only the same defences as the town.

The bazars offer nothing beyond the ordinary assemblage of men and goods pertaining to most Eastern bazars. They have been described by many travellers at various times when they were in a more flourishing condition. The streets are of the same narrow and confined form as other Asiatic cities, and a wander through them, if we except a few of the mosques and shrines,† affords a view only of blank brick walls with abutting balconies, closed or partially screened from a too prying curiosity. The interior of many of the older houses will, however, repay a visit, for they are handsomely ornamented with glass, and the walls are often embellished with Arabesque scrolls and verses from the Koran, or with couplets from favorite parts in both Persian and Arabic characters. They are too comfortably fitted up within during winter time, while the summer vaults or "Sirdabs" under ground are unique residences as necessary to the climate as they are curious to the stranger in these parts.

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* The walls said to have been built by the Khalif Mastadhir Billah are said to have been respectively for both portions of the city, as follows: Kams—East side 18,000, West side 12,000, total Kams 30,000. This quantity of the "Kam" is universally regarded as a fathom, exceeds the real length of the walls by the three-fourths of the number. It is either a gross exaggeration of Hamdallah Mustafa or an error in mistaking the "Kam" or fathom for the Draa or "Cubit" of seventeen or eighteen inches. The latter more generally used by orientals in masonic measurements, will about agree with modern observations.

† Some of these are really fine structures, and give to Baghdad the tone and character which generally pervades our ideas of an oriental city. In addition to this many shrines within the town, and held in great veneration by Mahomedan sectaries and the political importance of the country is greatly enhanced by similar erections in the districts adjoining the capital. I may instance Kathenein, Samara, Kerbela and Najuf, as towns which must ever attract the national cupidity of Shiah Governments, as well as attach themselves to the religious fervour of their people.

The nine views of Baghdad, which now follow, are kindly furnished me by Dr. Hyslop. These are photographs of his own taking, quite true, though somewhat indistinct, owing to deterioration of the collodion.

## General Remarks applicable to the Province.

Baghdad undoubtedly occupies a position which, geographically and politically considered, is an advantageous one. The existence of the present city for so long a time, and the remains of older and yet more celebrated capitals everywhere around its present site, confirm this in every respect. Ocular proofs too on every hand still point out the superior condition of its province in former ages, and these remnants of its prosperity should be the hand marks to guide a good government in working it at any future time. I allude, of course, to its dried up canals. These, originally drawn from the two great rivers Euphrates and Tigris, radiate in every direction both over Mesopotamia and over the tracts bordering to the east and west of either river; while the vast plains themselves which they formerly irrigated, lie deserted on either hand, shewing that history has neither magnified its resources nor drawn too highly colored a picture of its flourishing state. Its present degradation can be accounted for in few words, for though it maintained its character under the vigorous government of the earlier Khalifs, there can be no doubt deterioration took place with the Mahomedan conquest. The Arabs, indeed, acquired it from the Sassanian Monarchs in a healthy condition, and all that can be said is, that for a time they did not permit it to decay. The character of that people and of all the races which have subsequently held it, has been, however, either actively or passively destructive, for the apathy of the Ottoman rulers must be classed under the latter head. So long as they hold it, indeed, we must never look for its recovery, though there are not wanting enlightened Turks who lament its condition, and who are ever ready to propose new plans for its amelioration and progressive improvement. Were they in earnest even, we might still despair of success, from their want of means, either in money, or in the requisite skill.

At the present time, the Pashalik of Baghdad extends from the northern shores of the Persian Gulf along the Euphrates river as far upward as Anah, where the Aleppo districts commence. From thence a line drawn across Mesopotamia to the Hamrin range of hills, where it crosses the Tigris and led eastward so as to include the province of Sulimaniyeh in Kurdistan, bounds it to the north; its eastern limit being then defined by the line of the Shirwan and Diyaleh rivers as far as Khanikin, whence it skirts the foot of the Zagros, including the great plains as far as the Kerkha river west of Hawizeh, and thence to the angle formed by the meeting of the Shat-al-Arab and Mahome-

rah streams. This is a large and profusely watered arable tract of country, ranging over nearly five degrees of latitude and longitude, enclosing an area of available soil which I compute at fifty thousand square miles.

With the exception of Baghdad itself, there is scarcely a fixed abode deserving the name of town, though Basreh, Korneh, Semameh Hilleh, Musseyle, Hit 'Auh Tekrit, Samara, Sulimaniyeh, Khanakin, Mendalli, Badrai and Jessan are designated with the title. These are, however, the principal spots where communities of men in this province dwell within walls, though there are other villages and petty hamlets of mud construction on the Tigris and its tributaries north of Baghdad, as well as on the line of the Euphrates south of Hilleh. On the course of the Tigris and its arms south of the capital, if we except the miserable hamlet called Beled-al-Hye, on the Hye river, there is not a fixed abode. These great plains in fact are the wandering places of the nomades, whose various tribes give so much trouble to the government, and may be said to exist regardless of all laws, but those which are conventional among themselves.

The most powerful of these tribes are the Montafik, located between Semaweh and Basreh, and whose authority extends nominally to the Tigris south-west of the Hye, and south of the Hud Rivers; the Beni Laam who occupy the tract, east of the Tigris, from Kut-al-Amareh to the Hud River, and the Mesapotamian side of the Tigris south eastward of the Hye; the Zobeide, who range between the Tigris and Euphrates north of the Hye, as far as the Saklaweijeh canal to the west-north-west of Baghdad; and the Shammar Togeh and Deffafeh having their habitat in the great plains east of the Tigris and south of the Diyaleh, as far southwards as Kut-al-Amareh. In these tribes are comprehended many powerful families, but in the present brief report, I have no time to do more than name those who are nearly independent of the governing chiefs, and very often at open war with them. These are the Al-'bu-Mahomed, occupying the marshes north of Karneh and the banks of the Tigris as far as the Hud stream. Among Arabs they are in no estimation, being considered of an impure stock, and their occupation as mere buffalo proprietors and dwellers in reed huts, further degrades them in the eyes of those who boast of pure blood, and the profession of a creed which holds "border theft and high treason" as the greatest accomplishments in man, though in these respects the Al-'bu-Mahomed are not deficient, and are even powerful enough, screened as they are in fens and marshes, to beard the more aristocratical hordes who contemn them, and who will not give them their daughters in marriage, though they will ally themselves with the girls of their tribe. These are esteemed for their beauty and their "salt." It must be confessed, however, that the Al-'bu-Mahomed are a despicable set, neither courteous nor brave, but when strong, ca-

pable of committing every villany and theft for the least possible gain, or even out of pure mischief. They are comparatively rich in the Arab acceptation of the term; have good fire-arms and move about in light boats called "Mashoofs," which they handle admirably, and are the terror of those who trade by water from their exactions and cruelty, if denied. To coerce them is difficult, owing to their position, as when threatened, they betake themselves to the marshes and lie "perdu" among the high jungles of matted reeds where, in the creeks and mud, they are quite at home. The Ahl Yezaig, inhabiting the marshy tracts of the Euphrates, are much the same in mode of life and equally formidable in rebellion, but on the contrary they are more peaceably disposed; bear a higher character for Arab virtues, and, if not oppressed, are amenable to the authority of the Chiefs. I have dwelt longer on these tribes than I intended, but they differ from all others in this region, and a longer notice is necessary to comprehend their characters.

Had I time at my disposal, I would continue the sketch of the Arab tribes and enumerate their strength and resources in a detailed statement. This however is in preparation, and will form an appendix when complete.* To sum up generally on this head, owing to the nomade habits, I must add, they are one and all but little under the control of the Turkish Government. It is true, that a sort of tacit understanding exists between them and the authorities, that so long as the revenue at which the tribe is paid, they are to suffer no molestation. This assessment takes place annually, but much difficulty is experienced before the sum is fully paid up; the object of the Arab being to shew he is really too poor, and that of the Government to obtain, if well paid in one year, an increase of tribute in the next. Thus both parties fall out; are for the most part always at odds, if not at open war. Too weak to coerce them efficiently, the Government employs the usual weapons of the feeble, those of exciting party against party. Factions are thus raised in the tribes; the much coveted Sheikhships are sold, as it were, to the highest bidder, and a constant rivalry exists, fomented by the Government as an element to neutralize the combinations and rebellions so frequent in all ages among these singularly constituted people. It is this system, however, which has impoverished both the country and people.

The general character and habits of the Arab tribes inhabiting the region of which Baghdad is the capital, are much the same, and are exercised at all times without material distinctions so far as the public, that is those not immediately of their own clan, is concerned. Essentially the Arab is the foe of his fellow man, though he is not without a few redeeming qualities. In his domestic life

* It accompanies the present paper so far as my knowledge of them extends with any certainty.

he indulges in none of the revolting vices of the Towns, and, contrary to received opinion, he is averse to shedding blood except in retaliation for blood shed by others. This, indeed, is his law, and curious enough one that frequently stays his hand from murder for fear of the consequences to himself and his family. "Blood for blood" indeed has a terrible signification in his mind, for it renders him an outcast from his tribe, while he is in hourly expectation of an avenging hand. *When at peace*, he is mild, courteous and hospitable; tender and even playful occasionally, though the usual gravity of his manner would belie it. Much of this gravity is, however, assumed, and he can be, and naturally is, both cunning and treacherous. These are indeed the requisite accomplishments for his mode of life. Too proud and ignorant to work, and imbibing ideas from his ancestors, whose lot it was to be cast upon the most sterile and arid region of the globe, he dreams only of enriching himself by plundering others of the gifts which seem to him to be distributed by nature, so that he should exercise his strength in obtaining them. We should not, therefore, judge him too harshly, for his education *has taught him to steal*, though like other animals, who are obnoxious to communities, there is no denying, but he should be expelled, or even exterminated, if untameable. When guided by impulse, or necessity, he is passionate, exacting and deceitful, but not without principle when dealt fairly with by others. Like himself, those dealing with him should ever be suspicious of his intentions and on the alert to counteract them. Indeed, his own maxim "*never take a man for a friend until you have proved him not to be an enemy*" should be the guide for all, especially strangers, in their intercourse with these people.

On the Government of the Province and the "imperium in imperio" system pursued to weaken those who, when united, were able to set up in antagonism to authority, I have already touched. Generally speaking the form of administration in Baghad and in the minor towns is based on that of Constantinople, varied only to suit local usages and requirements when these do not operate badly upon the general law, which, of course, is that of the Khoran and the interpretations which learned legislators have awarded to its less intelligible doctrines. The old despotic rule has been closed for some years, and now a Council, at which the Pasha usually presides, hears and determines upon all cases. It is a mixed one of Mahomedans and Christians, but the latter in Turkey are not as yet sufficiently independent to do justice to their position when the Mahomedan portion may be biased by their creed, or by corruption to pronounce an unjust award. To speak candidly these nefarious practices in perversion of law and right, are less complained of in Baghdad than in most parts of the Turkish Empire, and under the more enlightened and honest administration of the present Pasha, Mahomed Reshid, they are less flagrant. He discountenances them, indeed, in his desire to benefit the state

and to raise his fellow Turk in the scale of humanity; a herculean task certainly, but the attempt is still worthy of commendation. Trained by education in Europe, the present Governor General of Irak has the tact and perhaps the energy to work a change in this neglected Province. Unfortunately he has no seconds. All his subordinates are as ignorant as Turks usually are, and his efforts are moreover often paralysed by the dogged obstinacy of their characters. The terrible pressure upon the resources of Turkey by the present war, is another drawback to him, for he is called upon to furnish funds, to aid, in maintaining the struggle, and with an exhausted exchequer, he must resort to an extra tax upon his people. Complaints are therefore as rife, as public improvement is at a stand still. Too poor to maintain an efficient staff in the various departments, the Fiscal arrangements of the Province, as well as the Police of the towns, are on the most slender and inadequate scale. Frequent and daring robberies, as well as loss of revenue, result from the want of force to levy the one and the absence of efficient means to check the commission of the other. There is in fact no system, and so long as governorship, public lands, custom dues, and the wholesale vending of many staple articles of commerce and food are held as monopolies by the highest bidders in the state auction, improvement cannot be expected. Every one of course works these with the greatest gain and least loss to himself, regardless of the effect upon individuals and the hideous consequences to the state. The regular army too in the Province is far too small for its extent in the most peaceable times, indeed, could a serious emeute arise in Baghdad itself, the whole force would barely suffice to put it down, and when the lawless character of the tribes around is considered, it is a wonder, indeed, that such a patchwork and threadbare form of Government can hold together at all. The secret lies, however, in the opposite elements of the governed body and the character of the general mind being too slow to work extended mischief. A love of repose and a singular apathy in the people to past, present, or future events, adds to the security, while it acts in an inverse ratio when we think of the energy necessary to effect improvement. On the whole, it may be said that the population is a quiet one. There is little appearance of fanaticism in it. The Jew and the Christian are tolerated and enjoy immunities which they do not elsewhere possess. The only tax upon them is Kharaj, or capitation tax, levied annually on males only, above the age of fifteen, in the proportion of about ten, five and two and half shillings per head. This exempts them from all other demands; and while the poor Mahomedan is often dragged from his wife and children, and made to serve as a soldier, these classes pursue their occupations in quiet in the midst of their families, and yet are not contented. But was the Oriental ever so? No; and moreover the Christians and Jews of Turkey while they are insidiously robbing all classes

of their neighbours, are ever ready to whine about oppressions, and unfortunately they receive attention from those who are ignorant of their characters and real position in Turkey. I venture to assert indeed, there is more real ill-will felt toward Jews in Europe than at the present time in Turkey, and the concealed hatred of Roman Catholics and Protestants manifests itself more in those civilised states, than it now does in the dominions of the Sultan. We have nothing to compare among Mahomedans with the Spanish denial of sepulture to their fellow Christians. Here every sect of Christians has its churches and cemetries, and the intercourse between individuals of totally different creeds in the common concerns of life is less restricted, and infinitely more courteous than among those professing Christianity under different denominations in Europe. Massacre in this country, solely on account of antagonistic belief, is a rare thing, and when it does occur, it arises more from its being the first political weapon at hand on the part of the rebellious towns-people against the Government, than from any inherent desire to shed Christian blood, and in some cases it has been brought about by the Christian parties themselves being urged to set at defiance the restrictions they had lived under in peace, if not in absolute freedom. The spirit that shews itself occasionally in England and Ireland has recently evidenced in the Wiseman ebullitions are but emanations having a similar tendency at heart, though fortunately for parties the bit is there firmer in the mouth. They nevertheless chafe a great deal.

The law of Tanzimat or Tansimat, suspending the infliction of capital punishment in the provinces governed by Pashas, has been productive of both good and evil. It was certainly wise and humane to place restrictions on the despotic will of local governors, particularly in the provinces near to Constantinople; but we may question if it was politic to set aside the punishment which held in check the lawless tribes of marauders that wander over a great part of the Turkish Empire at a distance from the capital. In Irak and its towns, the promulgation of this edict was looked upon by the evil as an amnesty for crime, and by the well disposed with alarm. Revolt, robbery, and murder increased, whereas the amputation of a hand or a foot, the timely impalement or public decapitation of a blood stained villain, (I must speak the truth while deploring the necessity) operated for a long time in these provinces on the public mind, though doubtless there were occasions when the absolute power of the Pasha might be exercised in ridding himself of people less obnoxious to the public than to himself. The law indeed has been too sweeping to be attended with entire good, for we observe offenders, after being convicted of parricide and other hateful murders, escape the death they have fully merited, and when immediate example was required by long confinement in prison awaiting a decision from Con-

stantinople. For the more distant provinces this law should be modified, so that retributive justice should immediately follow the commission of crime. I will not deny but that long incarceration may be worse than death to the offender. but such a mode of punishment is lost in these countries where example and precept are understood only through the channel of the eye. Here we might as well imprison a mule to deter others from kicking. The public mind is not yet enlightened enough to understand the motives, for the penal refinements of our European Codes.

The custom duties of Baghdad have been on the decline for many years, owing to various causes, the chief of which is the opening of the northern roads for the entrance of Russian and English manufactured goods into Persia and Asia Minor by Syria and the Black Sea. Of late too, the inconveniences and exactions which the Persian pilgrims experienced from the Turkish officials when visiting the sacred shrines in the neighbourhood of Baghdad, led to a law being passed in Persia prohibiting the pilgrimage. This journey combined the advantages deriveable from its sacred character and from the profits of commerce, for each individual became either a trader, or a pedlar, according to his means. Persian money thus flowed into Baghdad in a continued stream, and gave impetus to trade. This channel, exhausted by the Shah's order and disorders in the Pashalik itself, further impeded the exertions of its merchants. Under Reshid Pasha's government, however, commerce is again slowly reviving, and the road for devotees having been opened again recently by express permission of the Shah, we may yet see its bazaars in activity and its revenues increased; besides, in a political view, the renewal of the pilgrimage admits of a favorable construction being placed upon the dictates of the Shah.

The closing of the northern roads into Persia and Asia Minor, consequent upon the war now enacting in the territories around Mount Ararat and Kars should be, for a time at least, advantageous to Baghdad. The demands for goods from Persia and Anatolia must fall chiefly upon the three commercial entrepots, Aleppo, Baghdad, and Bushire, and central as Baghdad is with a fine water carriage by the Tigris, it offers the most ready market for the supply. The duties levied are upon the whole in favour of the enterprising European. They have been arranged by tariffs and special treaties, which the authorities at Baghdad and Basreh have always respected. These duties are under five per cent on an average, and amount to three per cent only when the goods are merely in course of transit to other places. Exports are charged from nine to twelve per cent. They consist chiefly of buffalo hides, tallow, salt, dates, wheat, barley, wood, horses, gums and galls, the produce of the mountains of Kurdistan. I wish that I could add to this list an article of native export manufacture, but I cannot remember, while writing, a single one. Those whom we meet here and in Asia Minor

generally are mostly clothed in Manchester fabrics, and their "harems" even derive additional lustre from the soft produce of the looms of England. This fact speaks little for the artisans of the soil at the present time, and contrasts markedly with the historical record which asserts that silken textures first emanated from the looms of Babylonia.

The ordinary length of caravan journeys from Baghdad to the following places are as under. They vary, however, from difficult means of transit over swollen streams and disturbance in the country. From Baghdad, not including stoppages

| | |
|---|---|
| To Mosul by Kerkuk | Twelve days. |
| To Tehran by Kermanshale | Eighteen days. |
| To Sulimanniyeh | Seven days. |
| To Khanakin | Four days. |
| To Damascus | Thirty days. |
| To Hilleh | Two days. |
| To Basreh | Fourteen days. |
| To Anah | Seven days. |
| To Hit | Four days. |
| To Samara | Four days. |
| To Badrai | Five days. |
| To Shuster | Twelve days. |

To the south of Baghdad however water transit is in more general employ.

The character of the great rivers which still give life to this tract will be best learnt from the brief report which accompanies this paper. It was drawn up last year at the request of Her Majesty's Minister at Constantinople, and contains, in a concise form, their capabilities for trade and navigation. To enter into a greater detail would exceed the limits I propose and the time at my command.

[*Copy of letter.*]

*Constantinople, May 26th*, 1853.

"MY LORD,—Your Lordship was pleased to desire a brief report of the present state of the Rivers Euphrates and Tigris; I have therefore the honor to furnish you with the following observations respecting them.

"The Euphrates has entirely lost its character as a navigable river for many years past, owing to the embankments, which formerly controlled the spring floods in the lower part between Suk-esh-Sheukh and Kornell, having been swept away about ten years back; indeed its capabilities for navigation at any time have never been great, though, I am aware, the general opinion, upon the reports of the Euphrates expedition in 1836, are in favor of it as a

feasible route to India. It must be borne in mind, however, that Colonel Chesney's vessels navigated the stream during the period of its highest rise, and in a year, too, when the flood attained some feet beyond its ordinary level; consequently, no obstacles were met with in the *descent of the stream* to lead to the inference that any existed. The contrary is, however, the case, for many obstructions, both artificial and otherwise, are found in its course, that develop themselves only in the *ascent of the stream*. These are impediments to navigation even in the season of its greatest height and during eight months of the year close its channel entirely to steam vessels of the most moderate draught of water. The character of the tribes located on its banks offers also a serious bar to its usefulness for commercial purposes, for I am convinced that, unless some great political change in the country interposes to coerce them, none but well appointed steam vessels of war could effect the passage, independent of the obstructions caused by shallows, ancient mill dams, and rocky ridges which traverse its bed from Hit northwards as far as the latitude of Aleppo. The rapids coursing over these during the freshes from April to June could only be surmounted, in 1841, by the steam vessel I commanded, with the aid of two hundred men attached to two ropes acting in concert with the steam power, and I question much, if the superior vessels now built could overcome them without similar assistance; at all events the delays that could ensue from the manœuvring requisite to effect the object would neutralize the advantages derivable from the agency of steam. A knowledge of its character in the autumn and winter may be gleaned from the fact of the descent in these seasons occupying the *Nitocris* from October to April. Her draft was three feet six inches, not more than would be requisite, perhaps, for a vessel carrying both cargo and passengers in addition to her fuel. In some places, indeed, it was necessary to remove every article but the engine, to ensure a draft of two feet six inches before these ridges could be crossed, and then only, after several day's hard labor with anchors and chain cables laid out to force her forward in the direction of the current of the river.

"Such were the impediments met with in 1841-42; now they are still more serious, for the river has left its bed at Al Hammar, south of Suk-esh-Sheukh, and is entirely lost in the marshes and vast swamps on either side, which, in the spring overflow a large tract of country and extend to the Persian Gulf. Since the embankment, alluded to in the first part of the report, gave way and immersed the surrounding country, boats of very light tonnage even have been compelled to transfer their cargoes to canoes at this part, for conveyance to Suk-esh-Sheukh, the market of the Montafik Sheikhs. To the anarchy existing in this tribe during the last six years, the change in this fine stream is, indeed, attributable; for the repair of the dams has been neglected in the

wars which, during this period, the rivalry of parties has maintained for the Sheikhship; and, weak as the Turkish authorities are now, we can expect no improvement in this respect, as each succeeding year adds to the rupture the waters originally made. It must, therefore, remain sealed to shipping until in the course of time it opens for itself a new channel.

"The Tigris, however, is eminently navigable from the sea to Baghdad at all seasons of the year by very ordinary steam vessels drawing three feet water. In the autumn, when in its lowest state, a little difficulty only is experienced, but this is easily overcome by common activity and attention to the proper channels. There are indeed no impediments to its navigation by steam vessels upwards for a distance of five hundred miles; and the tribes, though at times refractory, are in general less violent and exacting than those on the Euphrates. When the trading boats have been annoyed on this stream, it is in most cases traceable to the stinginess of the agents, and, I am confident, a more liberal policy, on the part of the merchants themselves, would secure the passage of their cargoes at any time. This applies to demands made on the tracking boats principally. Steam vessels would not be so liable to visits and importunities of the predatory families on its banks.

"From Baghdad northwards well found, fast, steam boats could reach the upper Zab, and with perseverance might attain as far as Mosul from February to June; at other times this portion of the Tigris is impracticable from the low state of the water.

I have the honor to be, &c.,

(Signed) FELIX JONES, Commander I. N.

In charge of the Naval Establishment on the Tigris,

and Surveyor in Mesopotamia.

"To His Excellency

Viscount STRATFORD DE REDCLIFFE, G. C. B.,

Ambassador Extraordinary and Minister.

Plenipotentiary to the Sublime Ottoman Porte."

Both the Euphrates and Tigris could, however, be rendered all that is desirable under a good Government. As it is, they become more destructive and less useful every year. The period of the greatest rise varies between the end of April and third week in May. The Euphrates remains at a high level longer than the Tigris, owing to its sources being in more elevated tracts. In the latitude of Baghdad the annual rise of both rivers averages 22 feet, but it occasionally exceeds 24 feet, and then the plains around are submerged, and Baghdad itself, owing to the want of proper precautions, is isolated for a time in a sea of water. Towards the end of October they have

subsided, into their lowest state; the Euphrates, where it has broken its embankments in the lower part, being then but ancle deep; but the Tigris remains available for navigation as shewn in the report.

The tides influence the stream of the rivers as far as one hundred and fifty miles from the sea, but the flood is not observed to run contrary to their course for the last thirty miles of this distance, in which it operates as a check upon the current, and this only when its force is not very strong. During the freshes the flood is sometimes observed to fail altogether, except on the spring tides, at which times the rise and fall, from the bar to Basreh, averages about eight feet, and this diminishes gradually to the Hud River on the Tigris, and to Negayb on the Euphrates, where a couple of inches of daily swell serves to mark the limit of this phenomenon in nature; and taking, as the zero of the scale, the junction of the Tigris and Euphrates, ten inches for every twenty miles of river course, will, as near as possible, mark the annual gradations in rise from the lowest level at the various places where the distances touch.

The best native boats in use are well adapted for their work. They are strongly built, and though rough, are of an excellent model. They draw, when laden, from four and a half to six and a half English feet, according to the season. These alone go as far as Basreh. They carry from eighty to one hundred and twenty tons, and sail well, when they can profit by the wind, which is very seldom on the passage up stream. The journey from Basreh to Baghdad occupies with a single band of trackers from forty to sixty days; with a double set a cargo has been brought to the city in twenty-two days. The distance by the river is little short of five hundred miles. On the upper part of the stream near Baghdad there is another form of boat used, called Siffineh and Teradeh. They are curiosities in model and construction, and are entirely coated with bitumen on the outside, or the stream would otherwise flow through them. They cannot have changed from the earliest periods; indeed, it is not unlikely, that their lines are those of the Ark of the Patriarch diminished only to suit modern requirements. The first named is used for bringing small wood from the jungles at no great distance, for the supply of the town and for other local wants. The second is small and chiefly employed in net fishing. The better sort of fuel is, however, brought to Baghdad in the Basreh trading boats, for it is plentiful only in the jungles around Kut and the Hye river. The Gufa or "coracle," a wicker basket coated with bitumen, is the ordinary vessel in use for passing the Tigris and for service near the town. It is very ancient, being mentioned by Herodotus and pourtrayed also on the sculptures of Nineveh.

I close the paper with the accompanying lists of the various breeds of horses, the most familiar species of the finny and ornithological groupes per-

taining to the Zoology of Irak, Babylonia or Turkish Arabia as it is more generally called. Specimens of the two latter I have already sent to Government, with a few of the minor insectivora included with them But we have here the lion, the wild boar, the hyena, wild cat, jackal, hares, porcupine, antelope, and spotted deer of the larger mammalia, besides a plentiful supply of the ordinary domestic animals, superior and inferior, of all communities, including the buffalo and camel. The leopard, cheetah and bear are to be met with also in the adjoining mountains of Kurdistan. Of reptiles and insects there are a goodly number, and the catalogue will shew they are sufficiently obnoxious to man. Snakes, no great variety and but one or two species of a venomous character—these are rearly met with. Water snakes plentiful, but harmlesss; scorpions large, abundant and venomous; wasps and drones, the same; bees scarce; musquitoes of five distinct kinds, and horse, probocis, and sand flies, all numerous and of very active, malignant habits, from the latter part of spring to the middle of summer they are ushered in by colonies of fleas. These drawbacks to comfort, however, end in the autumn; and a short sojourn in these countries soon renders one comparatively indifferent to them, and to many other annoyances of highly civilised life. Varieties of arichnidœ are plentiful, and myriapoda are common enough in the jungles about the river. The zealous entymologist will find also a swarming multitude of coleoptera, orthoptera, and nerorqptera, besides many beautiful species of epidoptera if he be inclined to woo them with the midnight lamp on a calm summer's night. Some small specimens of fresh water crustacea may be met with in the swamps and creeks, and a few varieties of mollusca are known. Entozoa exist in many of the animals, and the stomach of the pelican is almost always literally swarming with these parasites.

With the flora and plants of a larger growth, I am not very familiar. What renders the tract more celebrated in this respect than it would otherwise be, is its being the native country of the date, a tree which provides food for men, and animals, even in a region where at times in vigorous winters they might otherwise starve. I have not space to enumerate the fifty-two varieties which are known of this useful tree; but it is related that in the flourishing period of the Khalifate, Irak was so overspread with it, that on the main roads the traveller could pursue his way sheltered from the fierce rays of the sun. It is no longer the case now, for excepting the groves which skirt the river banks from the sea to the junction of the Euphrates and Tigris, and which extend in patches as far as Hilleh on the former river, there are none to be met with in all the tract until Baghdad is approached. Here immediately adjoining the city and at the villages watered by the Diyaleh, a few groves exist, which yield a plentiful enough supply, through considered as inferior in quality to the dates around Basreh; under the prevailing neglect these groves are diminishing

rapidly, being swept away annually by encroachments of the river. The Portugal orange attains perfection in Baghdad, and the gardens produce apples, figs, plumbs, almonds, grapes, appricots, nectarines, mulberries, nebecks or jujubes and pomegranates. If we except the latter all are of very ordinary flavor and growth. The pomegranates however is delicious. Usually there is an abundant supply of water and musk mellons in the season. The native vegatables enumerated in the lists in the first part of the paper are plentiful and cheap, but there is a great dearth of these asculents in the winter; of common flowers such as roses and stocks there are abundance, but others are rare.

To the above a list of medicines procurable in the Baghdad markets, chiefly from herbs found in the surrounding country, or the produce of Persia and Asia Minor, may not be irrelevant. I am indebted to Dr. James Hyshop, the Civil Surgeon at Baghdad, for this addition to the report, and those requiring more detailed information on the climate, diseases, and flora of Irak, will do well to seek it of him, for he has an ample knowledge of the subject and is ever ready to oblige enquirers.

This completes the report which has been hastily drawn up owing to the plan of Baghdad having occupied the whole of my disposable time for some months past, and other occupations now will not admit of systematic compilation. This must plead for errors and the rambling style throughout. As to the map, it will, I believe, be found as nearly correct as possible, for it has been the labor of many days, and it will be readily understood that such a work has not been completed without anxiety. To the tact and skill of Mr. W. Collingwood, a young officer of the Indian Navy, lately associated with me, I am materially indebted. The main features are all trigonometrically determined, and the detail of narrow streets &c. worked in chiefly by the aid of a prismatic compass. These must necessarily be imperfect in some respects, when circumspection is so necessary to works of this nature. Revered too as the name of Baghdad is in the East, and delightfully associated with our boyhood in the West, I may be permitted to hope that my labors have not been thrown away, especially at a time when the public attention is more immediately drawn to events enacting in Asia.

(Signed) FELIX JONES, Commander I. N.,
and Surveyor in Mesopotamia.

## ON THE TRIBES OF IRAK.

As an appendix to the general sketch I have drawn of the Arab tribes spread over Irak Babylonia, I now offer short notices of distinct families which have come under my observation, first however remarking these are distinct from the great Bedoin tribes which have either now settled in Irak or visit it

annually on plundering expeditions, or to adjust quarrels by the sword or negotiation as may appear advantageous to them at the time. The principal horde of these independent races is that of the Shammar Jerbeh, wandering all over northern Mesopotamia from south of Sinjar and the Khabur river to the Saklawiyeh, west of Baghdad, and even at times to the Hye stream. They are the terror of the Turkish authorities and people. They live entirely in the desert tracts, or rather tracts where they appear have become deserted; and as caprice or fancied neglects on the part of the authorities seize them, they issue forth on ghazus, or plundering excursions, carrying off every thing far and near even to the gates of the cities. Unable to drive them away, the Turkish Government has consented to pay their Chief a monthly salary to secure his allegiance, or in other terms, to buy the forbearance of the tribe. This, however, serves only a purpose, and, as the Chief Farhan says, is not sufficient to purchase coffee for his hourly recurring guests. A sort of hollow peace is however patched up by the contract, and comparative quiet broken only by occasional reports of petty plunderings, exists for a time. They are useful to Government only under general rebellion of the minor Arab tribes, when they are called upon to face on them with fire and sword, and are prompt enough generally in availing themselves of the permission. They sweep the country on these occasions. Friends and foes of authority are indiscriminately visited, and though there is not much blood shed, there is universal wreck. The tribes hasten to get out of their way, and so quick are Bedoin movements, that they succeed only in escaping from them with their families. Flocks, tents, household furniture, crops and kine are abandoned, and fall into Bedoin hands, to be driven off and sold at the lowest possible price to any who will pay them in ready money. Plunder being their only object, they care not to pursue the proprietors, for they have no real sympathy with the Government in these affairs. Farhan, the son of Sofuk, is the Chief of these people.

The Anizeh and Dhiffyr are the other Bedoin tribes which visit Irak in any strength. The latter generally locate in the desert about the Montafik territory to the west of the Euphrates, and occasionally make forays in southern Mesopotamia. They cross the Tigris also at times and levy contributions as far as Badrai and Mendalli.

Parties of the former range between Najuf and Deir on the west of the Euphrates, and content themselves with occasional forays only into Mesopotamia. They are generally at feud with the Shammar Jerbeh, and unless something offers as a bait, will not come readily on to their pasture grounds. They have not, indeed, force sufficient to match them; the strength of the Anizeh being spread at a distance over Syria. The Dhiffyr give assistance to

the Montafik in their wars with one another and with rebellious families subject to that tribe.

I may remark here as a general rule that these Bedoin tribes, and indeed all others, north of Hilleh in Mesopotamia, and Baghdad east of the Tigris, profess the faith of the Sunni Mahomedans; while beyond those limits to the south, they are of adverse principles and creed, being firm upholders of the doctrines of Ali and his unfortunate progeny. Such antagonistic feelings constitute the safeguard of the present Government of 'Irak, otherwise it could not endure, weak and despotic as it is.

*Tribe of Shammar Togha.*—Wander between the Diyaleh river as far as Kut-Al-Amareh, and from the east bank of the Trigris to the Nahrwan.

| *Families included.* | *No. of Tents.* | *Usual abode.* |
|---|---|---|
| As-Sadaan | 300 | From Kut to Mehdi. |
| Addallehbeh | 200 | From Debuni to Ziljeh. |
| Mejabileh | 150 | From Ziljeh to Dokhaleh. |
| Al-kafifan | 100 | From Dokhaleh to Kethiyeh. |
| Az-Zakuk | 60 | From Kethiyeh to Taj. |
| Menasir. | 40 | Daur. |
| Ad-delfiyeh | 40 | From Daur to Alaj. |
| Nafafisheh | 70 | From Alaj to Dialeh. |
| Al-Bawiyeh | 40 | On Nahrwan. |
| Mirdan | 40. | On Nahrwan. |

This tribe has been much divided of late owing to intestine quarrels. It is said to have been originally a branch of the Bedoin tribe Shammar Jerbeh; but having settled, as it were, into agricultural and pastoral habits, it lost its independence and was degraded. Togha, the affix of the original name, having been given them to mark this event and to separate them still futher from the proud race of the other name. It signifies a "necklace" "or badge of slavery." They have about 200 matchlocks or guns, and can bring about 700 horsemen into the field Their war cry is Sinaaish. They possess much cattle.

| *Families of the Daour.* | *Tents.* | *Usual abode.* |
|---|---|---|
| Beit Disbish | 70 | Zinyeh-Al-Zara. |
| Beit Abd-el Husseini-bn Khaled. | 70 | Der-Al-Akul. |
| Beit Tehmaz | 70 | Sened. |

The Daoùr are distinct from the above tribe, though found on the same locality. They act or did act formerly as guides and Government messengers, and in consideration of this paid no tribute, but were permitted to levy on passing boats five shamies, one helaneh of dates, and three pounds of coffee. They cross to the west of the Tigris when at feud with the Shammar Togha, and settle them near Shirsh and Shedhayf. They are considered good marksmen. They number 300 guns, and can bring 300 horsemen to the fight.

| *Family at Kut.* | *Tents.* | *Usual abode.* |
|---|---|---|
| Ashireh Kut Al-Amareh......... | 100 | Kut-Al-Amareh. |

This small family almost always occupies the same locality, that is both banks of the Tigris around the Hye stream. They have about 60 guns and a few flocks, but are wanting in camels and horses like the Daour. Their chief occupation is as guides, and for this purpose they have a small quantity of wheat and barley, and a couple of miserable hack horses awarded them annually by the Government, to whom they pay no tribute, and, moreover, are permitted to levy the same articles from passing boats as the Daour. Formerly they were in greater consideration, but their allowance has been reduced by successive Pashas. They are a quiet and useful people, being well known to the larger tribes. For many years the Sheikh has been employed by me as agent for the supply of fuel for the steam vessel. He has served too as my guide on many expeditions, possesses a good knowledge of the country, and in petty local affairs, both himself and his tribe, who are attached to us, have been very useful. They are of Shiah principles.

*Zobeid Tribe.*

| *Zobeid Families.* | *Tents.* | *Usual abode.* |
|---|---|---|
| Al-Maamereh .................... | 100 | Baghdadiyeh to Mahawil and Museyb. |
| Al-Merod .......................... | 200 | |
| Al-buwatif.......................... | 100 | From Abd-Allah to Baghdadiyeh and Nel. |
| Aduwijat ............................ | 100 | Brenij to Humanyeh. |
| Al-Jahish ........................... | 150 | Sherhan. |
| Ad-Delim............................ | 150 | Alwej. |
| Achellabiyin........................ | 200 | Mesalhiat to Beghileh. |
| Al-bu-Sultan........................ | 250 | Shumli to Euphrates. |
| Kiraghul.............................. | 100 | Shumli to Euphrates. |
| Al-bu Aja............................ | 100 | Anadel el-Irak |
| As-Said............................... | 200 | Huriyeh to Afaj |
| Ash-Shemamteh.................... | 100 | The Sheikh's Household. |

This great family occupies Mesopotamia south of the Saklawiyeh canal, as far as the Afaj marshes. It is both nomade and settled, mixed cultivators and predatory. They possess cattle in abundance and many good horses. The hereditary chief is Wadi; but of late owing to quarrels with the Government he has been disavowed, and his nephew nominally rules over the tribe. Most of the lands on the east and west of the Euphrates, especially about the Hindiyeh neighbourhood, are farmed by the hereditary chief and his adherents. Two years ago a price was set upon his head, and under the present Government he is the richest land proprietor in Irak. It is considered a powerful tribe, being able to raise 500 horse and 600 foot armed with fire-arms. They are of Sunni principles: generally support the Go-

vernment, but are much demoralized of late from intercourse with the town. Their war cry is Jeheysh, and their chiefs are from the House of Abdallah, an ancestor of great repute, who derived his pedigree direct from the Himyar (Homeritæ of Platemy) a very early and renowned race of Arabs in Yemen. Wadi ibr Sheflelleh, the hereditary chief, styles himself "of the House of Abdallah." Those boasting of immediate descent from this House, now comprise about 40 tents, and the whole tribe when required to make an oath of more than ordinary solemnity, regard swearing by the "head of Abdallah" as the most binding on their conscience, for it admits of no mental reservation. Indeed, the infringement of this oath, or taking it without full intention of keeping it, was formerly considered punishable with death; demoralization is undermining the old statutes of all the tribes.

| *Families.* | *Tents.* | *Usual abode.* |
|---|---|---|
| Al-Maamereh | 150 | Baashiyeh. |
| Ad-Duvejat | 200 | Resaseh to the Tigris on the East |
| Albu Kathr | 100 | Baashiyeh. |
| Beni Ajil | 100 | Rahamaniyeh. |

They are rich in flocks and herds, have good stock of horses and camels, and combine a settled and warlike character. In peace they cultivate extensive grounds, under Zobeid protection.

| *Families.* | *Tents.* | *Usual abode.* |
|---|---|---|
| Beni Zeyad | 100 | With Zobeid Sheikh. |
| Albu Bedran | 70 | Isken-deriyeh. |

The first generally attends the camp of the Sheikh. They are chiefly camel proprietors and carriers, and pay a tribute of 1000 shamies annually: the latter cultivate—and both have a few horse and footmen capable of going out to war.

| *Baij Families.* | *Tents.* | *Usual abode.* |
|---|---|---|
| Al-Hakarseh | 200 | Niffar. |
| As-Sueyd | 200 | Niffar. |
| Saadeh | 200 | Niffar and Mesherak. |

These families are of Bedoin habits and origin. They are remarkable as good horsemen, and can mount about 500 spearmen. They have few matchlocks and domestic cattle, but abundance of camels, amounting it is said to 5000. Their Sheikh is Aziz-al Kaim ibr Shian.

| *Arfiyd Family.* | *Tents.* | *Usual abode.* |
|---|---|---|
| Ashireh 'Arfiya | 400 | From Shumli to the Hye in Irak. |

This tribe is smaller than the Al-Baij, but like its people are classed as Bedoins. They can muster 300 horsemen, armed with spears, but have few matchlocks. It is said they have 3,500 head of camels, but in other cattle they are considered poor.

| *Al-Hamid Family.* | *Tents.* | *Usual abode.* |
|---|---|---|
| Al-Ahmid | 300 | In Irak north of the Hye. |

Classed as Bedoins like the two former tribes, mount 300 spearmen, boast of few guns, and, excepting in camels, are poorly off for cattle, of these they number 2000 head.

| *Amareh Families.* | *Tents.* | *Usual abode.* |
|---|---|---|
| Aderijat | 100 | From Tessaaiyn to Hye. |
| Al-Atatfeh | 100 | In Awudek, North of the Hye. |
| AlA-abed | 150 | From Huish to Rumiyeh. |
| Al-bu Gharbi | 100 | From Rumiyeh to Aznibir. |
| Ahelijiyeh | 50 | From Azniber to Bedaeh. |
| Al-bu-Atiyeh | 100 | From Bedaeh to Abadiyeh. |
| Ajghanat | 50 | From Abadiyeh to Zikh. |
| Waled Aberkeh | 30 | From Zikh to Bither. |
| Al Berisat | 100 | Yusufiyeh. |
| Al-bu Amireh | 100 | Heram. |
| Arubaiyn | 100 | Umm-al Bini. |
| Al-bu-al Heh | 100 | On Nifeshiyeh. |
| Waled Faraj | 50 | Abu Ahmar. |
| Ar Rutham | 50 | Bither. |
| Al Hamas | 100 | Abu Zufer. |

This tribe some thirty years back was one of the most powerful in Irak, and ruled with absolute authority, both to the north and south of the Hye river, setting the Government frequently at defiance and levying black mail from all around. The increased power of the Montafik under the rule of Daud and Ali Pashas served, however, to break them, and now they can give but little annoyance. Their late Sheikh was Deroish Al'Amir, the latter being the distinguishing title of the tribe. They possess about 500 matchlocks, some good horses and plenty of camels, sheep and oxen. They have frequent quarrels with the Beni Laam. Their war cry is Akhuyet Saadeh.

| *Amareh Families.* | *Tents.* | *Usual abode.* |
|---|---|---|
| Myah Beyt Nasr | 200 | As-Sedifeh. |
| Al-Kerim | 200 | North of the Sedifeh. |
| Ar-Zemhha | 100 | Al Abel. |
| Az-Zeyed | 100 | Bedat Arhameh. |
| Ad-Debat | 100 | Bedat Rudan. |
| Az-Zuahed | 100 | Abu Ajhirat. |
| Al-Gharib | 100 | Al Jezreh. |
| Al-bu Amrah | 60 | Wasit el Hye. |
| Al-bu Ayisa | 100 | Al Akar. |
| Ad-Duiheri | 100 | Junction of the Hye with the Euphrates. |
| Al-Kuwishat | 50 | Tmet al Tul. |
| Al-bu Ajaj | 40 | Kazmet al Hye. |

These portions of the Amareh are now living under the protection of the Montafik Sheikh, and cultivate lands assigned them by that personage. They are poor, and pay for the lands they occupy an assessment of 300 shamies. They have lost the character of Bedoins from their more settled mode of life.

*Tribe As-Seraj.*

| *Families.* | *Tents.* | *Usual abode.* |
|---|---|---|
| Ad-delfiyeh.................. | 250 | Aj-jilibyeh. |
| Habjiyeh.................. | 70 | Rejajeh. |
| Ad-diyaa.................. | 50 | Sid-al Nasiyeh. |
| Al-Gharib.................. | 50 | Al Bejiyaiyk. |
| Al-Abid.................. | 50 | Al Muwakef. |
| Ferateseh.................. | 200 | Ashib Abu Bezaziyin. |
| 'Aakyie.................. | 200 | Al Hemireh. |
| Al-Mekasis.................. | 100 | Bedat Ajie. |
| Al-bu Debkhi.................. | 100 | Al Kherij. |
| Al-bu Reshadeh.................. | 120 | Nahr Tamer. |
| Al-bu Habib.................. | 70 | Al Kubbeh Ali. |
| Al-bu Kashi.................. | 70 | Nahr ibn Jesam. |
| Beni Akbeh.................. | 150 | Al Hamidyieh. |

These families of As-Seraj wander over Mesopotamia, south-east of the Hye, as far as the Hud river. They own allegiance to the Montafik so far as being protected by the Sheikhs of that large family, but are really almost independent. The tribute levied upon them is usually 12,000 shamies annually, but unless threatened it is seldom but partially paid. Of fire-arms they can muster about 400, and can, perhaps, bring double the number of mounted spearmen into the field. Their war cry is Akhuyet Hamdeh. They are rich in Arab estimation, and possess large flocks and herds of cattle, besides camels. They give protection too to a few buffallo proprietors, and are much feared by native trading vessels.

| *Family.* | *Tents.* | *Usual abode.* |
|---|---|---|
| Al bu Deraj.................. | 500 | From Al Awnair to Al Jebileh. |

The families of this tribe I am not conversant with. They give allegiance sometimes to the Beni Lamm, and sometimes to the Montafik. Their tribute is 4,500 shamies annually. They wander between the Tigris and Euphrates south-east of the Hye, and are rich in camels, horses, sheep, and have about 200 guns.

| *Disjointed Families.* | *Tents.* | *Usual abode.* |
|---|---|---|
| Ad-deriya.................. | 200 | From Jebeleh to Shetaniyat. |
| Al-Mayoof.................. | 150 | From Shetaniyeh to Awudeh. |
| Al-Mariyan.................. | 200 | From Awudeh to Hor. |

These are great pastoral families on the same general locality, south-east of the Hye, under Montafik jurisdiction. They do not cultivate but possess

great herds of cattle, flocks, and a few horses. They may have 350 guns among them.

The principal tribe inhabiting the districts on either side of the Euphrates south of the Hye river is the Montafik. The chief family is descended from one of the ancient Sherifs of Mecca, whose name was Maneh, and who had fled from the holy city fearing the consequences of a feud in which he was involved. It would take too much time to recount, in the present paper, the history of Maneh's proceedings. It will suffice to say, that having by his talents worked himself into authority in the districts which the tribe inhabits at present, he managed to bring the various families under one head. Thus united they took the name of Montafik as that of the tribe—at least such is the report. Its direct genealogy is given as follows :—Maneh married the daughter of Barakat ibn Mullij-esh-Sherif, and had offspring—Mahomed who begat Sadun, who begat Shamer, who begat Mahomed, who begat Shamer, who begat 'Agie, who begat Mahomed, who begat Faris, who begat 'Agie.

The chief families of the tribe were from the Beni Simim, the Beni Malek-al-Ajwad, the Beni S'ayed Al Kafajeh, Beni Rekab and the Bedoor.

The tribe is now divided into two parts : the Al Ajwad portion inhabit the districts north of Suk-esh-Sheyukh, round Semaweh and the regions of the Hye river;—the southern Montafik districts south of Suk-esh-Shegyukh to the Persian Gulf eastwards as far as Hawizeh, and north-east as far as the Hud, are in the posession of the Beni Malek, improperly pronounced Malick—with the exception of the house of Shibbyb. The tribe professes the Shiah faith of Islam. That name applies to the family of the present Sheikh as does the name of Sadun. These are of Sunni principles. Their war cry is " Azyud," while that of the Beni Malek,or the Beni Tenan-ez-zeydan, as they are sometimes called, is " Yetun."

For the last five years this powerful tribe has been chiefly occupied in war ; party struggling against party, cousin against cousin, for the Sheikhship. The Turkish Government has fomented these discords, and within the last two years three Sheikhs have been acknowledged. Mansur-es-Sadun now reigns, having been lately invested, but he has met with much opposition from his subjects ; and his two rivals, Saleh and Faris, are at hand, the one in Baghdad and the other in the desert not far off, to work on the prejudices of the Pasha as soon as a cause for dissatisfaction may exhibit itself in his mind. The country governed by the Montafik is, therefore, much impoverished, for the cultivating tribes inhabiting it are so oppressed by succeeding Sheikhs, that their lot is a hard one indeed. Suk-esh-sheyukh is the chief seat of the family governing the tribe. It was a favorite mart of the Arabs, and much trade was carried on when the Montafik were at peace with each other. Many influ-

ential traders resided there, but the late troubles have sent them away to escape from the rapacity of the contending Sheikhs. The tribute paid to the Baghdad treasury by the tribe varies according to its strength, and the means the Turkish Government has of enforcing it; but ordinarily it may be computed at a lack and half of shamies a year in money and presents to those in power. The tribe is rich, however, and could afford to pay much more than it consents to do. The whole date districts are in its hands, and it further possesses abundance of cattle, horses and flocks, besides large herd of camels. The territory is rich also in rice grounds, and there are many tribes of cultivators living, even rich, under Montafik protection. Of these the Ahegezair and Beni Mansur are powerful bodies in themselves.

Next in order to the Montafik is the great tribe of Beni Laam, occupying both banks of the Tigris from the Hye river to the Hud. They are said to derive their origin from one Waul, a contemporary and comrade of Khaled in the wars of Mahomed, whose power united them under a common banner. Their name, Beni Laam, signifies "the collected sons." Like the Montafik they have become broken from internal jealousies fomented by the Turks. Two Sheiks now govern separate portions of the tribe. They are thus greatly weakened. They pay an irregular tribute, but they are assessed at about a lac of shamies, excluding contingent presents.

| *Ashair Beni Laam Families.* | *Tents.* | *Locality.* |
|---|---|---|
| Al-Syrkheh | 100 | Ali Ghurbi |
| Al-Waymi | 200 | Al Gubhoor to the Hills. |
| Ash Shihhalal | 100 | Ali Sherki to the Hills. |
| Al-Khasrej | 250 | Nahr Saad to the Hills. |
| Ad Dilfiyeh | 70 | Jawriyeh to the Hills. |
| Al-Hassan | 250 | Jibbeyleh. |
| Al-Nebgan | 120 | Amareh. |
| Al-Athhibad | 100 | Ghardali. |
| Al-Halfa | 400 | Habbesiyeh. |
| Al-Jaasureh | 120 | Al Jebel. |
| Al-Awuneh | 60 | Al Nuaseh. |
| Al-Harb | 350 | Kharsaniyeh. |
| Al-Debbeyis | 200 | Al Haddam. |
| Al-Hamzeh | 50 | Bisheh. |
| Al-Kananeh al Kamr | 500 | Amareh. |
| Aa-Dereissat | 600 | With the Sheikh. |
| Al-bu Teradi | 400 | Amareh. |

This is the native estimate of their strength, but I believe it to be much overstated, an allowance of a gun to a tent I deem to be their strength in this arm. They are good horsemen, have plenty of flocks and herds, besides camels and tolerable horses. When at feud with the authorities they stop the trade by the river, and at all times levy a toll on passing boats. They encourage cultivators from the Luristan mountains near them,

to cultivate the great plains they occupy, but do not degrade themselves by tilling the ground. They take the daughters of the neighbouring Al-bu Mahomed tribes as wives, but will not give their females in marriage to them, or, indeed, to any race inferior to themselves. Mufkhoor is the present hereditary Chief. He is rapacious, bigoted and niggardly; hence he has but a partial deference shewn him by his people. The tribe are all Shiahs, of a fanatical class. When pressed by the Government they fly into the Persian territories bordering upon Hawezeh. Some portion of this tribe, at open strife with the rest, has been located in Persian territory for years past. They give protection to Madaan families, who pay for the pasture of their buffaloes on a portion of the territory assigned them by the tribe. These families are given as under :—

| *Families of Madaan.* | *Tent or Huts.* | *Locality.* |
|---|---|---|
| Assonaad | 300 | Bil Alonah. |
| Al-Hemeydan | 200 | Al-Mothimmeh. |
| As Sonadan | 400 | Al-Wajef. |
| Aj Joweybir | 100 | Al-Kusseh. |
| Al-Zeyry | 300 | Abu Arabid. |
| Al-Hharishin | 200 | Bil Makriyeh. |
| Ar Rubiya | 150 | Abu Jathiya. |
| Al-bu Abud | 150 | Al-Akeishi. |
| Beni Tarf | 100 | Al-Harsheh. |

They are strong in guns, though not so formidable in other respects, having neither horses nor camels. There chief riches are in herds of buffaloes and a few flocks of sheep.

Unlike the real Arabs they reside in huts made from the reeds abounding in the marshes.

The Beni Laam might be able to bring 15,000 horsemen into the field if united, but certainly not 5,000 in their present state; and if we allow a gun to every third man of these numbers, we shall have, I think, more than their effective strength in fire-arms.

The undermentioned Arab families wander in Mesopotamia, west of Baghdad, as far south as Musseyib.

| *Families.* | *Tents.* | *Usual abode.* |
|---|---|---|
| Al-Abu Aamer | 250 | Nahr Dawudi. |
| Beni Timim | 300 | Akr Kuf. |
| Az-zoba | 300 | Nahr Abu Gharayb. |
| Al-Tedagheh | 150 | Nahr Mahmudiyeh. |
| Al-Birghut | 130 | Nahr Rathwaniyeh. |

They are mixed agricultural and pastoral families, but they are warlike; possess some good horses, and if we allow a gun to a tent, we shall have their strength in fire-arms. The three first are of Bedoin blood, but degenerated.

The following tribes are met with to the north-west of Baghdad, above the Saklawiyeh canal, chiefly on the right bank of the Tigris.

| *Families.* | *Tents.* | *Usual abode.* |
|---|---|---|
| Al-bu Sagr | 200 | From Saklawiyeh to Suadiyeh in the Desert. |
| Al-Meshahedeh | 350 | From Taji to Tarmiyeh. |
| Aj-Jebour | 140 | On the District called Taji between Kathemen and Tell Goosh. |

The first of these is wholly pastoral, and of Dellim blood originally. It pays tribute direct to Baghdad. The two last cultivate lands usually pertaining to the farmed district of the Dijeil. They have cattle in plenty, a few horse, and are capable of maintaining a position in a territory exposed to Bedoin visits. A gun to a tent will exceed, perhaps, their strength in fire-arms. They are expert thieves, and indulge their propensities in petty ways unusual with the tribes in general.

*Tribe of Dellim,* whose territory is chiefly upon the east bank of the Euphrates, from west of Baghdad to the north as far as the town of Hit.

| *Families.* | *Tents.* | *Usual abode.* |
|---|---|---|
| Al-Maamdek | 100 | From Saklawiyeh to Nemaleh. |
| Al-Dhuweyb | 100 | Al Ghurbut. |
| Al-Maamdek | 90 | From Saklawiyeh to Nemaleh. |
| Al-bu Shhab | 200 | Nemaleh. |
| Qirtan | 60 | Al'Aosijeh. |
| Al-bu Obeyd | 100 | Umm at Rus. |
| Al-bu Alwaan | 100 | Kabr Feraj. |
| Al-Jenabiyin | 300 | Zoweyht al Feraj |
| Al-bu Rageybeh | 50 | Ditto. |
| Al-bu Feraj | 60 | Sheikh Hadid. |
| Al-bu Dhiyab | 200 | Ditto. |
| Al-bu Assaf | 100 | As Sifeyneh. |
| Al-bu Nimr | 300 | Nefateh (Naphta Springs) to Sinadek. |

The tribe is powerful in Arab signification. Its families are rich and combine the peaceful character of the cultivator with the warlike one of the Bedoin. Many of its more aristocratic chiefs and people will not indeed till the soil, they of course fatten upon the spoil obtained from the weak. The territory they inhabit is a rich one, and 340 irrigating wells in the districts are counted, as belonging to the tribe. Each well is supposed to pay to the Zabit of the tribe, on account of Government, one ton of barley, half a ton of wheat, and the value of about thirty shillings in money at every harvest, but much of this payment is evaded, owing to the weakness of the Government.

The territory of the Dellim on the west of the Euphrates is celebrated also for its natural springs of fine water, which in the spring of the year overflow and fall into the Euphrates. In the summer the waters recede, but the ground

which they have left moist, is carefully sown with grains, and plentiful crops from this source alone are obtained.

These natural fountains called Thannayl and Abu'l-kir are situated about 4½ hours north-west of Kaleh Rahmadi.

The latter, as their name implies, are impregnated with bitumen, but the water, otherwise, is said to be good and wholesome. The whole district of the Dellim from Hit southward is said to be more or less prolific in sulphur and bituminous productions, particularly where the springs are thermal and salt, as at Hit, having a temperature of about 93°. Much salt is obtained from them by evaporation.

Though the occupations of the Dellim are chiefly pastoral, the security of their position, their strength and character for riches, leads them to offer much opposition to the Government, for the Bedoins readily join them when inclined to be lawless and refractory. The tribe itself, indeed, usually throws the blame of its actions upon those people who are ever ready to father the sins of others so long as they enjoy hospitality and good fare free of expense; for "say its me" costs them little at any time. The temper of this tribe is very uncertain from these causes. The roads between Hit, Baghdad and Hillet are kept in constant alarm; caravans suffer plunder and violence, if not murder attends the forays they are engaged in. In the spring they wander as far as the Dijeil and Tekit on the Tigris for the benefit of the richer pastures for their flocks. Were they united they might muster 10,000 fighting men, with a third of that number armed with fire-arms. They possess camels, flocks and herds in abundance; are hospitable, and some of the Chiefs whom I have met, possess an intelligence above the ordinary run of Arab races.

*Tribes located near the Dijeil, north-west of Baghdad.*

| *Families.* | *Tents.* | *Usual abode.* |
|---|---|---|
| Al-Khasrij | 130 | Dijeil. |
| Al-Majummeh | 200 | Beled and Kanturch Harbeh. |
| Al-Makadmeh | 150 | Sumeychch to Tigris. |
| Beni Timmin | 250 | Khatheyreh. |
| Al-bu Hujaza | 150 | Neighbourhood of Jebbareh and Beled. |
| Aj-Jeneyleh | 130 | Between Sumeycheh and Beled. |

The Dijeil is the canal cut from the west bank of the Tigris just below Samara, and waters an extensive district formerly containing a vast population that resided in towns, which are now seen in ruins on the deserted channel of the Tigris. They are cultivators, principally in the employ of the Zabit of the Dijeil, who farms the land to them. They are rich too in flocks and herds. Portions of them are pastoral and some predatory, for they join the Bedoins at times in their forays. All are petty thieves on every occasion. A gun to a tent and a mounted spearman to every three tents is the full measure of their strength when united.

*Tribe of 'Abeyd, north of Baghdad.*

| *Families.* | *Tents.* | *Usual abode.* |
|---|---|---|
| Al' Abeyd | 150 | Shabeycheh. |
| Ash Shaivi Zadeh | 100 | Shabeycheh. |
| Abu Aljeh | 300 | Near and around Kerkuk. |
| Al-bu Hyaza | 200 | Al Aith. |
| Al-bu Aly | 150 | Hamrin. |
| Al'bu Reyash | 150 | Hawi Lek-lek. |

The above occupy the land opposite the Dijeil, around Samara and the Katuls, and extend from the east bank of the Tigris to the Hamrin hills and Kerkuk. They are of ancient lineage, and known also as the Al'bu Shahr, or "illustrious." They are predatory and strong in horse and camels. Their Sheikh Sadun gives much trouble to the authorities.

*Indiscriminate Tribes.*

| Families. | Tents. | Usual abode. | Remarks. |
|---|---|---|---|
| Ash Shawan. | 200 | On Lesser Zab.. .. | Chiefly pastoral, but predatory on occasions; they are known under the general name of Al'bu Hamdan. |
| Al Bekr. | | North of the Zab .. | |
| Al Tui. | 500 | South of great Zab. | Cultivators and predatory; have many camels. |
| A Beya th. | 300 | Between Tuz, Khurmati & Kifri. | These are more of Turkish than Arab origin. They are rich. They cultivate and are cattle proprietors. In war they are bound to give military service to the Government. |
| Al-bu Sehnan | 200 | Zab el Kebir | Cultivators as well as predatory. The last make long forays at times, as far south as Baghdad. Suliman Mirza was killed by a party of these close to Kathemein. |
| Al-bu Hamad | 150 | Eski Mosul | |
| Beni Zid. | 100 | Eski Kifri | These are chiefly cultivators and cattle proprietors. |
| Beni Timin. | 150 | Between Sindiyeh and the Atheim.. | These are portions of an ancient Nejd family, but degenerated into settled cultivators in various parts. |
| Beni Timin. | 300 | Belad Ruz | |
| Au Nedeh. | 300 | Mendali | Cultivators, and predatory at times. |
| Khasrej. | 100 | Dholoiyeh Hawis ... | Cultivators on the Dijeil districts. |
| Al Kerkhiyeh. | 300 | Keshkul & Syedelan. | Chiefly cultivators. |
| Au Naim. | 100 | Hamrin | These are chiefly of the "Memon" order; many of them profess great sanctity and go about as Syeds and Dervishes. They have camels and horses. |
| Aj Jebur. | 300 | Dholiyeh Hawis .. | Cultivators. |
| Al Kerwiyeh. | 300 | Kara Teppeh | Cultivators chiefly, but they have some camels. |

The tribes enumerated in the foregoing pages are those which I am best acquainted with in Irak. With many I am familiar, but with others I have no more knowledge than from Native report, which is not always to be depended upon. Their numbers and strength must, therefore, be considered at best [illegible] an approximation, for to obtain truth in a country where no statistics are k[illegible], or recognized, it becomes a difficult matter to extract it from the immense mass of fable constantly in the mouths of these singular people, who frequently deceive, either from suspicious motives, or from mere wantonness of character. There are other tribes too which I have been silent upon altogether, as in a month or two I may be able to offer a more correct account of them than I am possessed of at present. These inhabit the land and marshes west of the Euphrates, tracts as yet untrod by Europeans, but which I propose to visit in a short time.

(Signed) FELIX JONES,
Commander and Surveyor.

*Baghdad, October 8th,* 1854.

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## HORSES.

I have been furnished with the following list of the various breeds of horses of Neja blood, which are known amongst the Shammar Jerbeh, the Anizeh and Dhiffyr, the chief Bedoin tribes in Syria and Mesopatamia, the principal or chief stock is that named Kahilet Umm-al Arqub, from whence the others are derived in the following order :—Saklawiyeh Gedran, Saklawiyeh Aouber, Hadbeh Anizehi, Hadbeh-el-Berdawil, Hamdani Samri, Kahileh-an-Nawaq, Maankiyeh Hederij, Al Kubeysheh, Jilfeh Adhueh, Rubdeh, At-taweyseh, Abeyt Sherak, At-terafiyeh, Krush, Saklawiyeh Ayeibijeh, Ash Sheheyb, Kahileh al Mossaneh, Abeyt al Hamreh, Wadhneh Khorassan, Al Jaesheniyeh.

These fine animals can be procured with difficulty from the tribes, though the foals born from them of inferior mothers are readily disposed of to the dealers. To procure first rate horses in Baghdad, however, is at all times difficult, for the dealers generally secure them with a view to profit in the Indian market, and unless some disproportionate sum be offered they will not part with an individual horse, for they say it spoils the sale of the rest. Horses of no pretensions or of very little blood, can be got varying in price from 50 Rupees to 700 Rupees. Males can be bought also in the town, but Persia affords the best supply. Their price is from 150 Kerans to 250, between 70 and 120 Rupees. Of donkeys there are a goodly assortment. The white donkeys from Bahrein is a fine creature, and fetches about 70 or 100 Rupees. Even common donkeys of the place may be had at all prices. Camels and dromedaries are readily procurable, the best usually selling for about 80 Rupees each, and an inferior one costs about half or third of that sum. Those found in Mesopotamia carry about three hundred weight, and are not fitted for journeys beyond the plains, but there are others available on the frontier tracts adapted to mountain roads. These too carry ordinarily a hundred weight more. Mares of inferior breeds can be had, but these of superior stock are jealously preserved by the Arabs. Abbas Pasha of Egypt offered two thousand pounds for a mare of the Ashshehyeh breed, but it was refused by the Dhiffyr Bedoin her owner. This type of horse is said to be found only among that people.

*Fragmentary portions of the Zoology of Irak, Babylonia.*

*Vertebrata, Birds and small Carnivora.*

| Family. | Arab Names. | English Equivalent | Remarks. |
|---|---|---|---|
| Phœnicopterus. | Gharinuk. | Flamingo. | |
| Platalea | Maghairif. | Spoonbill | |
| Bataurus | Abu-al-Wak. | Species of Bittern. | |
| Unknown. | Jerrydi-al-Nakhl. | Mungoose. | |
| Corvus | Ghrab Aswad. | Crow. | |
| Gruido | Beyuthi. | Paddy Bird or Crane. | |
| Corous frugilegus. | Zagheh. | Rook | |
| Aptenodytes | Waswas. | Penguin species. | |
| Mumenius | Nakus. | Curlew. | |
| Strigido | Bumeh. | Owl. | |
| Unknown | Tetweh. | | |
| | Tetowiseh. | | |
| | Tetwaneh. | | |
| Perdix rufus. | Hejil. | Rock or Desert Partridge. | |
| Unknown. | Shakerrak. | | |
| Alcedo | Tusseleh. | King fishers. | |
| Alcedo | Asleyl Ag'a | | |
| Unknown. | Amriaye. | | |
| Unknown. | Shijruj | | |
| | Sagalageh. | | |
| | Khuthreh. | | |
| Francolinus | Darraj. | Francolin. | |
| Scolopax | Dejàj-al-'Ard. | Solitary Snipe. | |
| Columba | Tuarni. | Wood Pigeon. | |
| Unknown. | Sowah. | | |
| | Kersua. | | |
| Columba | Takhtaiyeh. | Turtle Dove. | |
| Unknown. | Srati. | | |
| | Kudri. | | |
| Unknown. | Tebu. | | |
| | Ghrab Abka. | | |
| | Sarsmeh. | | |
| | Shejrej. | | |
| | Hudhud. | | |
| | Kattah. | | |
| | Sueydeh. | | |
| | Abu Hakeb. | | |
| | Deheruj. | | |
| Cheeroptera. | Khashafel-leil. | Bat. | |
| Unknown. | Berhan. | | |
| | Erhymi. | | |
| Erinaceous | Kunfed | Hedge-hog. | |
| Unknown. | Haya Kebri | Snake family. | |

*Zoology of Irak continued.*

| Family. | Arab Names. | English Equivalent | Remarks. |
|---|---|---|---|
| Falconido | Hadeyieh | | |
| Anas | Sabcghi | Species of Duck | |
| Acripiter Falconisus. | Bashag | Sparrow Hawk | |
| Anas | Sugluk | Waders | |
| Anas | Ankutheh | | |
| Phalacrocorax | Ahlegchi | Cormorant | |
| Bataurus | Sebareh | Bittern family | |
| Phalacrocorax | Ghakeh | Cormorant family. | |
| Rallus | Dejaj-al-Mai | Landrail | |
| Anas | Arkheywi | Wader | |
| Ardea | Shheyby | Heron family | |
| Falconido | Semeychi | Hawk family | |
| Larus | Guaqueh Segheir. | Gull | |
| Limosa | 'Aaweydi | Gadwit | |
| Bataurus | Abu Ghatuwieh. | Bittern family | |
| Sturnus | Zerzur. | Starling | |
| Ibis | 'Anazeh | Black Ibis | |
| Querqudula | Shur-al-Segf | Summer Teal | |
| Grallatores | Breyji | Coot | |
| Columba | Kumri | Doves | |
| Scolopax | Ferrar | Snipe | |
| Falconido. | Abu hak 'Abyeth | Hawk species | |
| Rallus | Dueych-er-ruz | Wader family | |
| Rallus | Do. Segheir | Ditto | |
| Colymbida | Deheyrij | Ditto | |
| Ditto | Khuweywit | Ditto | |
| Phalacorcorax | Hakhak | Cormorant species | |
| Aquila | Akleymi | Eagle family | |
| Do Vulturina. | 'Aakab | Vulture Eagle | |
| Bubo Virginianus. | Haameh | Great horned Owl | |
| Dafila acuta | Choshem | | |
| Plotus | Tamashed | Pelican family | |
| Falco Peregrinus | Shahin | Hawk family | |
| Unknown | Abu Jeradi | | |
| | Kateh Hindawi | | |
| Larus Argentatus | Zerqueh Ghafi | | |
| Falconisus | Atmejeh | Hawk | |
| Unknown | Amdeyfir-elkatch | | |
| | Dhherjeh | | |
| Columba | Hemmamet-al-Hussein | Pigeon class | |
| | Yepellagha | | |

*Vertebrata continued—Fishes of Babylonia.*

| Familes. | Arab Names. | English Equivalent | Remarks. |
|---|---|---|---|
| Mullus................... | Shabut.......... .... | | Weight 15 lbs. |
| | Jerriyeh......... ... ... | | Do. from 5to6 lbs. |
| | Buniyeh... .............. | | Do. 9 lbs. |
| | Shilg.................. ... | | Do. 7 lbs. |
| | Bezr...................... | | Do. 6 lbs. |
| | Gataneh...... .......... | | Do. 7 lbs. |
| | Bertimeh................ | | Do. 5 lbs. |
| | Ajraneh...... ...... ... | | Do. 4 lbs. |
| | Arratheh................ | | |
| | Abu Sueyf...... ....... | | |
| | Shilg Segheir... ....... | | Weight 3 lbs. |
| | Bez......... ............ | | Do. from 90 to 120 lb |
| Squalus .... ....... | Kosij...... ...... ...... | Common Shark found 500 miles up the Tigris. | |
| Testudo & Chelonia. | Rakeh and Refesh... | | The former is the common Testudo Groca, but the latter is a Turtle peculiar I believe to the Tigris and Euphrates. |

*List of Medicines, Drugs, &c., procurable in the Bazars of Baghdad.*

| English Names. | Arabic Names. | Whence procured. | Prices. Per. | Rate Rig Piastres. |
|---|---|---|---|---|
| Absinth....... ... .......... | Afsentin............. ... | Persia......... ...... | 72 grains. | 2 |
| Acid, nitric................ | Tezab ........... ...... | Baghdad... ......... | 72 ,, | 1 |
| Acid, sulphuric.......... | Dehn Kebrit... .. ... | India............ ... | 72 ,, | 3 |
| Almonds, bitter...... ... | Gauzel murr... ... ... | Baghdad............ | 3 lb.troy, | 40 |
| Almonds, sweet......... | Gauz halew... ... ... | Baghdad............ | ,, ,, ,, | 40 |
| Aloes...... ........ ...... | Sabr...... ...... ...... | India... ........ .. | ,, ,, ,, | 80 |
| Alum......... ......... ... | Shabb........... ...... | Persia............... | ,, ,, ,, | 14 |
| Anise seed.......... ... | Anisun.................. | Aleppo... ... ... ... | ,, ,, ,, | 30 |
| Antimony, sulphuret of. | Kohel........... ...... | Europe... ...... ... | ,, ,, ,, | 30 |
| Arsenic......... ... ...... | Sammel faz............ | Europe... ... ...... | ,, ,, ,, | 50 |
| Asarabacca............... | Asarun...... ......... | Syria......... .. ... | ,, ,, ,, | 40 |
| Assafœtida......... ...... | Tuivifeb ............... | Persia............... | ,, ,, ,, | 40 |
| Bastard Saffron......... | Kurtum...... ......... | Persia...... ......... | ,, ,, ,, | 10 |
| Benzon...... ......... ... | Geban ................. | India...... ......... | ,, ,, ,, | 12 |
| Betelnut black... ... ... | Faufal aswed ......... | India...... ...... ... | ,, ,, ,, | 12 |

| English Names. | Arabic Names. | Whence Procured. | Prices. Per. | Prices. Rate in Rijo Piastres. |
|---|---|---|---|---|
| Betelnut, white... | Fanfal byad | India | 3 lbs. troy. | 0 |
| Black Cumin seed | Habbet es-sanda | Baghdad | " " " | 12 |
| Camphor | Kafur | India | " " " | 160 |
| Cantharides | Dharnuh | Kurdistan | 9 oz. " | 80 |
| Cardamom seed | Hayl | India | 3 lbs. " | 12 |
| Carraway seed | Gheznarj | Baghdad | " " " | 40 |
| Carrot seed | Bezr el-Tazar | Baghdad | " " " | 10 |
| Cassia fistula | Kasab el-felus | India | " " " | 40 |
| Castor | Tend | Persia and Egypt | Bag. | 40 |
| Castor oil | Dehn al Kharua | Baghdad | 3 lbs. " | 40 |
| Cinnamon | Dar Sini | India | " " " | 80 |
| Chamomile flowers | Babunej | Persia | " " " | 12 |
| Chareveel | Fahm | Baghdad | 128 lbs. " | 40 |
| Cloves | Kronfiel | India | 3 lbs. " | 60 |
| Cocculus Indicus | Zahr es-Samak | India | " " " | 20 |
| Coccus Cacti | Karnaz | Europe | " " " | 360 |
| Coral | 'Erak Murjan | India | " " " | 400 |
| Colchicum | Sulinjam | Egypt | " " " | 40 |
| Colveynth | Hanzal | Baghdad | Pod. | 5 |
| Copper, Sulphate of | Zinjareh | India | 3 lbs " | 40 |
| Coriander seed | Kuzberah | Baghdad | " " " | 10 |
| Cream of Tartar | Melh tartir | Europe | " " " | 50 |
| Cucumber seed | Bezr el-Khiyar | Baghdad | " " " | 20 |
| Cumin seed | Kammun | Baghdad | " " " | 40 |
| Dill seed | Bezr er-ziban | Baghdad | " " " | 16 |
| Dragon's blood | Domm al-akhuwayn | India | 9 oz. " | 100 |
| Endive | Hendeba | Persia |  |  |
| Endive seed | Bezr Kendeha | Persia | 3 lbs. " | 20 |
| Epsom Salts | Melh Franje | Europe | " " " | 120 |
| Eupherbaim | Farfayun | Persia | " " " | 40 |
| Fennel | Badyan Khatai | India | " " " | 60 |
| Fenugriek | Hobbeh | Baghdad | " " " | 5 |
| Figs | Tin | Baghdad | " " " | 20 |
| Flea-west | Kotuniyah | Persia | " " " | 10 |
| Fois Grapes | 'Enab eth-thaleb | Persia | " " " | 16 |
| Galls | 'Afes | Kurdistan | " " " | 24 |
| Gamboge | Rabb ruind | India | 9 oz. " | 60 |
| Garlic | Thum | Baghdad | 3 lbs. " | 8 |
| Gentian | Tentiana | India | 72 grs. | 4 |
| Ginger | Zenjefil | India | 3 lbs. " | 20 |
| Gum Ammoniac | Wushak | Persia | " " " | 20 |
| Gum Arabic | Samgh Arabi | Baghdad | " " " | 40 |
| Gum Galbanum | Kasni | Persia | 9 oz. " | 14 |
| Gum Koordish | Samgh Kurdi | Kurdistan | 3 lbs. " | 10 |
| Hemlock | Bezr al-benj | Persia | " " " | 40 |
| Honey | 'Asal | Kurdistan | " " " | 30 |
| Iron, Sulphate of | Zaj | India | " " " | 16 |
| Jalap | Chalpa | India | " " " | 400 |

| English Names. | Arabic Names. | Whence Procured. | Prices. Per. | Rate in Rije Piastres. |
|---|---|---|---|---|
| Jugube, red | 'Enab Ahmar | Persia | 3 lbs. troy. | 10 |
| ,, black | 'Enab Aswed | Persia | ,, ,, ,, | 10 |
| Juniper | Abbul | Baghdad | ,, ,, ,, | 40 |
| Kino | Katar Mekki | India | 9 oz. ,, | 100 |
| Lac | Gakk | India | 3 lbs. troy | 30 |
| Leek | Kurrath | Baghdad | ,, ,, ,, | 10 |
| Lettuce seed | Bezr el-Khass | Baghdad | ,, ,, ,, | 20 |
| Lime | Nurab | Baghdad | ,, ,, ,, | 4 |
| Lime juice | Ma lumi | Baghdad | ,, ,, ,, | 20 |
| Linseed | Bezr kittan | Baghdad | ,, ,, ,, | 10 |
| Liquorice, extract of | Rabl-es-sus | Aleppo | 72 grs. | 1 |
| ,, root of | Asl-es-sus | Baghdad | 3 lbs. troy. | 5 |
| Mallows, common | Kadumeh | Persia | ,, ,, ,, | 40 |
| ,, marsh | Werd khetmi | Baghdad | ,, ,, ,, | 20 |
| ,, ,, seed | Bezr khetmi | Baghdad | ,, ,, ,, | 20 |
| Manna | Mann | Persia | ,, ,, ,, | 100 |
| Mastic | Maslaki | Constantinople | 72 grs. | 2 |
| Mercury | Zaybak | India | ,, ,, ,, | 1½ |
| Mulberries | Tuki | Baghdad | 3 lbs. troy. | 80 |
| Musk | Musk | Persia | 72 grs. | 80 |
| Mustard | Khardel | Baghdad | 3 lbs troy. | 10 |
| Myrrh | Murr Makki | Mekka | ,, ,, ,, | 60 |
| Naphtha, black | Naft aswed | Persia & Baghdad. | ,, ,, ,, | 10 |
| ,, white | Naft abyad | Persia | ,, ,, ,, | 50 |
| Nitre | Shurah | Baghdad | ,, ,, ,, | 10@30 |
| Nutmeg | Tauz bua | India | Cwt. | 1 |
| Nux Vomica | Tauz el-kayq | India and Persia | 72 grs. | 4 |
| Oil of Almonds | Dehn lauz | Baghdad | ,, ,, ,, | 1 |
| ,, Linseed | Dehn kittan | Baghdad | 3 lbs. troy. | 45 |
| ,, Olives | Dehn Zeytun | Baghdad | ,, ,, ,, | 40 |
| ,, Peppermint | Dehn Nana | Baghdad | Ounce. | 60 |
| ,, Sesame | Siraj | Baghdad | 3 lbs. troy. | 40 |
| ,, Turpentine | Taramentin | Kurdistan | ,, ,, ,, | 14 |
| Olibannum | 'Elk-el-laban | Kurdistan | 9 oz. ,, | 16 |
| Opium | Afyun | Smyrna & Persia | 72 grs. | 5 |
| Opoponax | Towashir | Persia | 3 lbs. troy. | 60 |
| Pepper, black | Fulful aswed | India | ,, ,, ,, | 30 |
| ,, Cubebs | Kubabek Sini | India | ,, ,, ,, | 60 |
| ,, red | Fulful Ahmar | India & Baghdad | ,, ,, ,, | 30 |
| Peppermint | Mana | Baghdad | ,, ,, ,, | 20 |
| Pomegranate flowers | Werd-Rumman | Baghdad | ,, ,, ,, | 20 |
| Poppies, black | Khashkhash aswed | Persia | ,, ,, ,, | 30 |
| ,, white | Khashkhash abyad | Persia | ,, ,, ,, | 30 |
| Prunes | Alu Bubhala | Persia | ,, ,, ,, | 30 |
| Purslain | Barbin | Persia | ,, ,, ,, | 20 |
| Quince seed | Bezr Safarjal | Persia | ,, ,, ,, | 30 |
| Rhubarb | Rowend | Smyrna | ,, ,, ,, | 400 |
| Rosemary | 'Eklil el-Malek | Baghdad | ,, ,, ,, | 10 |

| English Names. | Arabic Names. | Whence Procured. | Prices. Per. | Rate in Rije Piastres |
|---|---|---|---|---|
| Safflower | 'Asfur | Persia | 3 lbs. troy. | 30 |
| Saffron | Zafaran | Persia | 72 grs. | 4 |
| Sagapenum | Sokapenj | India | 3 lbs. troy. | 40 |
| Sal Ammoniac | Shenader | India | " " " | 80 |
| Sarsaparilla | Ashbeh | India | 9 oz. " | 1 0 |
| Scammony | Sakmuniya | Egypt | 72 grs. | 80 |
| Soda, Carbonate of, impure | Kalia aswed | Baghdad | 3 lbs. troy | 6 |
| Do do. do. pure | Kalia abyad | Baghdad | | |
| Spikenard. | Sinbel et lib | India | 72 grs. | 2 |
| Sponge | Esfinj | India | " " " | 3 |
| Star Anise | Badiyan Runu | India | 3 lbs. troy. | 60 |
| Sulphur | Kebrit | Kurdistan | " " " | 20 |
| Sweet Basil | Fanjemushk | Persia | " " " | 40 |
| Sweet Flag | Kasah ez-Zuwayrah | India and Persia | " " " | 40 |
| Tamarinds | Tamr hindi | India | " " " | 14 |
| Tragacanth | Kathira | Persia | " " " | 20 |
| Turmeric | Kurkum | India | " " " | 24 |
| Verdigris | Zinjar | Aleppo. | " " " | 500 |
| Vinegar | Khall | Baghdad | " " " | 10@12 |
| Violets | Werd benefsheh | Persia | " " " | 80 |
| Wax, Bees | Shama 'asal | Kurdistan | " " " | 90 |
| Wild Rue | Hormal | Baghdad | " " " | 5 |
| Zinc, Oxide of | Tutya abyad | Persia | " " " | 40 |

(Signed) FELIX JONES.

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ART. IV.—*Remarks by* Lieutenant SELBY, I. N., *during the Survey of the Malabar Coast,* 1849 51. — *See Preface, p.* xix. xxi.

ANGRIA'S BANK,—Centre in lat. 16° 30' N., long. 72° 5' East, extends 23 miles in a NW. and SE. direction, is 10 miles broad, and has on it a depth ranging from 12 to 17 fathoms—coarse sand, coral and shells. It is on the very edge of the great bank of soundings, which extends off the Malabar Coast, having close round it from 160 fathoms on West to 110 on East side, from which the soundings gradually decrease in towards the land. At 2 miles from it, on Western side, no bottom could be obtained at 250 and 300 fathoms, and at 10 miles none at 460 fathoms. The water is not discolored, and though in running for it we were keeping a careful look out, the first indication that we were upon it was given by the lead, no sign of shoal water being at all percepti-

ble. In a moderate N. Wly breeze we found the swell on it less than in the vicinity, and I have no doubt a vessel, not making much way in a fresh N. Wester, could anchor there with advantage.

The flood tide runs to N. E., ebb to W. S. W., about 1 knot per hour. High water, on full and change, at about 10. 30. Rise and fall 9 feet.

Great Bassas de Pedro Bank, called "Munyulpar" by the Natives, extends from lat 12° 31′ N. to 13° 36′ N., centre in long. 72° 30′ E., and is from 8 to 16 miles broad. The shoalest part is on the Northern end, where we found 21 fathoms, deepening gradually to the Southern, where the soundings are regular, from 33 to 35 fathoms. The bottom throughout coarse sand, decayed coral and broken shells. It is very steep too, in most places no bottom being found close to it with 300 fathoms of line. We however obtained soundings on the very edge of it at 270 fathoms, and as the vessel drifted over it, the lead was dragged up the side, deeply cut into by, and bringing up several pieces of sandstone rock.

We found the tides here very irregular, in fact for 10 days, from 28th December to 6th January, while on the Northern and centre part of the Bank, we had a constant set to W. N. W. of from 1 to ½ a knot per hour. After this from the 7th to the 10th January, while on the Southern end, it was from N. E. to N. N. W. ¾ of a knot per hour, the wind being throughout from North to East, Easterly to N. E. during the night and until about 10 A. M., then hauling to Northward—but seldom in this month, as far to Westward as N. N. W.

Little Bassas de Pedro Bank or Coradeeve, bears from N. Western point of Great Bank N. West, 15 miles.

It is 19 miles long, and 4 to 6 broad, running in a N. N. East and S. S. W. direction, and has on it a depth ranging from 25 to 30 fathoms,—coarse sand, decayed coral, and broken shells; steep too like the Great Bank, and no soundings could be obtained between them at 308 fathoms.

Sesostris Bank, discovered by Captain Carless, I. N, in April 1847, in the H. Co's Steam Frigate from which it is named; bears West, 15 miles, from centre of Great Bassas Bank. It is about 15 miles long in a N. W. and S. E. direction, 9 or 10 miles broad on the N. Western end, narrowing to a point of about 2½ miles broad on Southern edge, on which in one place we found only 11 fathoms. It is very steep too, having no bottom at 300 fathoms close to it. On the very edge however, we obtained soundings at 140, 180, 190, 220, 260, and 295 fathoms,—sandstone rock. The centre is in lat 13° 7′ N., long. 71° 58′ E.

Being of the same formation as the Great and Little Bassas de Pedro and Angria's Bank, and lying in the same parallel of longitude as these, and the centre of the Laccadive group, it may reasonably be concluded that it is

coeval with them. It seems strange therefore, that it should so long have remained undiscovered, as it is the only one on which the bottom is discernible, and on the southern edge, green and dark patches are not only distinctly visible from the mast head, but from the deck, the chain cables or other small objects lying on the bottom can be plainly seen. The bottom, coarse sand, broken shells, madrepore, and decayed coral.

We were at anchor on and in the vicinity of this bank from February 20th to March 1st,—wind from N.W. to N.E., generally blowing fresh at night from N. W., and with a current setting all the time from S. W. and S. E. The rise and fall of tide we ascertained to be 5 feet.

Cherbanian Reef, called Belliapani by the Natives, Southern end in lat 12° 17′ N, longitude 71° 52½′ E., is 6 miles long and 2½ broad, pear-shaped, and lies in a North and South direction, the broad end being to the Northward.

This very dangerous shoal is composed of a barrier reef of live coral rock, inside which the depths vary from 1 to 5 fathoms—sand, thickly studded with coral patches. No part of it is dry at all times, except a patch on the Northern end, where the dry and dead coral rock is heaped up, both naturally and artificially, and which at high water is about 10 feet above the level of the sea, and another on the Eastern side, at nearly the centre, where there is a bank of sand, which though but little elevated above the sea, yet from being so white is visible from the deck of a vessel about 5 miles. Here also is an entrance into the lagoon, there being at high water 2 fathoms. This passage is used by the Laccadive islanders, who resort here in great numbers to fish, which with turtle are found in great abundance. At very low water springs however, the rocks are awash all round.

From the centre towards the Southern end a bank of soundings extends off it, for a distance of from 150 to 250 yards, but at the Southern end it runs off for a distance of ½ a mile, gradually deepening from 2½ and 3 fathoms close to the breakers, to 15 and 20 on the edge, next cast no bottom. The rise and fall on the springs is from 7 to 9 feet, and round the South end the ebb runs to W. S. W. 2½ knots per hour. Flood N. E. 1 knot. High water, full and change, 10 hours.

There is very good anchorage off the Southern end. A vessel wishing to make this point, and coming from Eastward, may run close along the reef until on S. Eastern edge, when she may haul up in from 6 to 9 fathoms, and anchor with the centre of breakers, bearing North, distance about 500 yards. She will then have the Western extreme of breakers N. W. by N., where good shelter from a N. Wester will be had, and in approaching this reef it should be borne in mind, that there are no dangers but those which are visible.

Although however no danger is to be apprehended in making it in the day time, yet at night it is very dangerous to approach, as no indication of danger can be perceived until close upon it. No soundings can be obtained within ¼ of a mile except on the South point, and unless there is much swell, the surf does not break, so as to be seen or heard a sufficient distance to warn a vessel running into danger.

BYRAMGORE REEF, called Cheriapani by the Natives, South East end in latitude 11° 48′ N., longitude 71° 51′ E., is a very dangerous and extensive bank of coral, extends 10 miles in a N. N. West and S. S. East direction, by 4½ miles broad, and has soundings all over it from 1 to 11 fathoms, but with numberless detached and sunken patches of coral rock in every direction.

It is of the same formation as the Cherbaniani, from which it bears South by West 17 miles—steep too, having no soundings, at 300 fathoms, within ¼ of a mile. Unlike that bank, however, it has not a barrier reef all round, except on the South West, South, and South Eastern extremes, where a heavy surf always breaks. Besides these, there are two patches on the North Western extreme, and two on the North Eastern, and all which are dry at low water spring tides.

From the South Western and South Eastern points of the reef, the soundings extend off a distance of nearly ½ a mile, gradually increasing from the breakers, to about 15 fathoms on edge of bank of soundings, and afford good anchorage; but between these points it is very steep too, no soundings being obtained 300 yards from the breakers.

Anchorage close in may, however, be obtained all along the East and West sides,—and extending 7 miles from the Northern extreme of the reef, is a bank of regular soundings, from 4 to 8 fathoms, affording good and perfectly safe anchorage in any season. The bottom sand and coral rock.

Across the centre of the reef, between the breakers on the North Western extreme and the Southern part of the reef, is a passage, where, should a vessel find herself embayed, she might, as a last resource, and with a good look-out from the fore yard, run over the reef, and as the water is beautifully clear, and all the dangers clearly visible, avoid the sunken rocks with which it is thickly studded.

The tidal wave, which sets round and along the Cherbaniani reef, by which the danger likely to arise from being becalmed near it is considerably lessened, meeting here much less opposition than is there offered by the complete barrier which constitute that shoal, in many places sets across the Byramgore. There is however little danger to be apprehended from this cause, as this only happens in those places where, from the formation of the reef, a vessel might always anchor in time to avoid drifting into danger.

Where the reef is steep too, and anchorage can only be obtained very close in, the tide, as at the Cherbaniani, sets *along* the reef, and the danger is consequently much lessened.

The remarks I have made on approaching the Cherbaniani reef at night, are equally applicable here, and if in their vicinity, too much caution cannot be observed, the currents running very uncertainly and strong.

Except in the immediate vicinity of the reef, the flood tide sets to the North Eastward, ebb to West South Westward; rise and fall on the springs 6 to 8 feet. High water, full and change, 10 hours.

The Laccadive islanders frequent these reefs to fish, which they catch in great quantities, and with the cocoanut is their staple and almost only article of food.

CHITLAC.—The Northern island of the Laccadive group, South end in latitude 11° 41′ N., longitude 72° 42′ 30″—is a low sandy island, covered with cocoanut trees, 1½ mile long and nearly ½ a mile broad, and may be seen from a vessel's deck 10 miles.

On the Eastern side it is very steep too, there being no soundings 200 yards off shore, but is surrounded on the Western side with a barrier reef, off which a bank of soundings extends in places to a distance of nearly ½ a mile, gradually increasing from the edge of the reef to 15 and 20 fathoms on edge of bank of soundings.

Between the reef and island is a lagoon, into which, through a natural channel in the reef, their boats are taken, and where they are completely sheltered. The bottom, a fine sand with coral patches. The best anchorage is off the South end of the island, in from 7 to 9 fathoms—coral rock about 400 yards off shore. The rise and fall of tide we found to be 7 feet. High water, full and change, at about 10 hours.

Chitlac contains a population of about 500 inhabitants of the Mopla cast. Like all the inhabitants of this group, they are a very poor but inoffensive people, living entirely upon fish and cocoanut, the only produce of these islands, with a little rice, which they procure from the Coast.

They export to the Malabar Coast large quantities of raw coir and coir-yarn. This is received from them by the Collectors at Cannanore and Mangalore at a fixed rate. It is of a most excellent quality, and much better than that of Malabar. The rope made by the islanders is for strength and durability far superior to that which is produced on the Coast.

From having had the weight of the gale at North, this island must have been on the Western extreme of the hurricane, which passed up the Malabar Coast in April 1847. It has therefore suffered comparatively little, when the ravages committed at Undewo and others of the islands, lying more to the

eastward, are remembered. It lost only about 600 trees, but this, on an island which counts about 3,500 altogether, was seriously felt, and the inhabitants gratefully remember the assistance rendered them by Government at a time, when from the loss of some of their boats, they were in great distress.

Water and supplies may be procured here in small quantities, and at a very cheap rate; and we invariably found the natives most civil and obliging.

KILTAN ISLAND,—South end in latitude 11° 27½′ N., longitude 72° 59′ 40″ East, bears from Chitlac South East ½ East 20 miles. It is about two miles long by ¼ to ½ mile broad, and like Chitlac has a barrier reef all round the Western side, with good anchorage off both the Northern and Southern points of the island. Water may be procured here, and indeed at all the Laccadive islands; as however it is merely the sea water filtrated through the coral, it will not keep very long,—it may however be used with safety, as we filled up both here and at Ameen, and found no ill effects resulting from its use. A few limes may also be obtained,—with this exception it produces nothing but the cocoanut; and it is from this island and Chitlac that the best coir is procured, and it would perhaps be worthy the attention of Government that in a late trial made between the rope manufactured at these islands and that sent from the Coast, for the Naval service, the one from the islands, both in strength and texture, proved very far superior to the other.

This island having been nearer by 20 miles to the centre of the hurricane of April 1847 than Chitlac, has suffered in a much greater degree, and the Northern part of the island, where its violence was most felt, has been entirely denuded of trees and vegetation, and on the Eastern side, a belt of about 150 yards broad,—by the whole length of the island of uprooted trees, and masses of coral rock, thrown up from the steep side of the island—attests how great must have been the fury of the gale, and violence of the waves.

From a measurement which I took of some of these masses, I estimated their weight to be from 1 to 2½ tons, and many of them are now lying 150 yards from the beach, left there by the receding waters.

Two thousand trees are said to have been uprooted, and a channel of 20 yards in width and 10 feet deep now remains to shew where, on the gale decreasing, the sea, with which the island had been partially submerged, returned to its own level.

In conclusion I would only observe that, with respect to the characteristic features of this island, the remarks which I have offered on Chitlac, together with its inhabitants, their mode of life, &c., equally apply here.

A succession of calms and much bad weather, during the latter part of the season, prevented our surveying more of these islands than those I have

now attempted to describe ; and I entertain no doubt, from information obtained at some of them, that other, though not dangerous banks, unknown to us, exist within the compass of this group.

The channels between these islands are, however, perfectly safe, and much frequented by Bugalahs and other vessels, trading between the southern ports on the Malabar Coast and Coasts of Africa and Arabia. In proceeding to the Westward, they generally stop at Ameen, complete their water, and barter rice and cloth for cocoanuts.

In the latter end of March and until the middle of April, when all vessels bound to the Westward are leaving the Coast, this island is much frequented. During that time in 1847, more than twenty large Bugalahs, and four square-rigged vessels passed Ameen. One, a fine new Bugalah, amply laden with rice, &c., was totally lost on Botia Par—a very dangerous reef and island lying in the direct track of vessels, bound to the westward; this however, from want of time, I was unable to survey,—I have however inserted it into our chart as taken from Captain Moresby's work.

A stay of only four months among these islands does not enable me to offer any opinion on the winds and weather generally experienced, which may be considered as invariably the rule. I have no doubt, however, but that the few observations I have to offer will be found generally correct.

From December until the vernal equinox the prevailing winds are from W. N. W. to N. N. E. After the equinox we had a constant succession of calms, until the 8th April, from which time until the end of the month we experienced constant bad weather, at times the wind blowing a gale generally from S. E. In this latter particular it was considered by all the natives a remarkable and unusual occurrence, although about this time they generally expect some degree of bad weather.

In the early part of the season, viz., from December to February, we found the current almost always setting to W. N. W., during the latter part of February and until middle of March to S. W. and S. E., and from that time until we left, which was early in April, the current was setting to Eastward and S. E.

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## ART. V.—*Memoir relative to the Hydrography of the Persian Gulf, and the knowledge that we possess of that Sea.* By Lieutenant CHARLES G. CONSTABLE, I. N.

(*Read before the Bombay Geographical Society* 21*st Feb.* 1856.)

FOR the last twelve years I have taken a very great interest in the maritime geography of the Persian Gulf, and have collected a considerable amount of data towards forming a hydrographical memoir of its shores.*

In collecting these materials I have had in view as a primary object the improvement of its hydrography, but at the same time I have taken pains to collect such information, respecting the localities and the people, as seemed likely to be generally useful. I have found how difficult it is to obtain information regarding these shores; that which is contained in Horsburgh being necessarily very brief from the vast scope of the subjects of which he treats, and unavoidably imperfect from the imperfect materials at his command when his work was written.

It is undoubtedly true that the recent editions of Horsburgh contain a short account of the Persian Gulf from the survey made thirty years ago, but since that time there has been no addition to our knowledge of that Sea.

It happened that about twenty-five years ago, from the fact of the navigation of the Persian Gulf being obstructed by the depredations of pirates, it was necessary to employ a considerable squadron of ships of war, commanded by experienced officers, to cruise about there. At that time a good deal was known of the navigation of the Gulf, but it was knowledge confined to the officers so employed, and was not then made available for public purposes by being recorded in any permanent way, and has since that time passed away with the officers, who are all either dead or have left the service.

Major T. B. Jervis, in his address delivered in August 1838 at the Geographical Section of the British Association, New Castle on Tyne, descriptive of the state of the surveys instituted by the Hon'ble East India Company throughout Asia, regretted that there existed few, in some cases, no written memoirs to accompany the surveys; and he added that the survey of the Persian Gulf required circumstantial explanatory memoirs for navigators; with regard to the charts he remarked, that the height of the lands skirting the coasts has been omitted, and that the want of a better mode of expressing the form and character of the ground within sight of the navigable shore is much to be regretted.

In the Transactions of the Royal Geographical Society, Vol. 8th, in a note by the Editor prefixed to Lieut. Whitelock's "Descriptive Sketch of the

* This refers to a Sailing Directory, and Description of the Shores and Islands of the Persian Gulf, which I am preparing, and which I hope to bring out at some future period.

Islands and Coast situated at the Entrance of the Persian Gulf," it is observed, "and here, perhaps, it may be permitted to regret that—although this important survey of the Persian Gulf has been finished more than eight years—no complete account of it, nor any description of the coasts, has yet been published."

Thirty years have now elapsed since this survey was made, during which period the vessels of the Indian Navy have continually cruised about within the Gulf. From time to time the officers employed there have discovered dangers which had escaped the observation of the surveyors, errors in the position and form of certain portions of the shore, and omissions in the way of hills, forming landmarks, of forts and villages, &c. In some cases, notices of such have been sent into Government, but doubtless many valuable notes have been lost by their possessors having left the service.

In short there is a weight of evidence to prove that our present knowledge of the Persian Gulf is imperfect; and from this fact being pressed upon me by my own experience, as well as from the testimony of others, I was led to devote my attention to the subject as a fruitful field for research, which no one else had entered upon, and as an inquiry likely to be fraught with most valuable results to the public service of this country.

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The E. I. Company's Chart of the Persian Gulf is compiled from surveys made by several officers between the years 1821-8. A glance at the chart is sufficient to satisfy any hydrographer of its incompleteness; it will strike him at once that vast portions are unsounded, and this too where the water is shoal, and there is every reason to expect the existence of dangers. (I am here alluding more particularly to the upper portion of the Gulf, over towards the Arabian coast, say all west of the meridian of 50°.) There is a vast extent of unsounded ground in the southern basin of the Gulf,—I mean between Cape Moosendom and Cape Reccan, say all south of the parallel of 26°. Then looking to the entrance of the Gulf, it will be observed of the northern or Persian side that from Ormuz downwards and along the Mekran Coast, no soundings have been taken out from the shore; and the same remark applies to the Arabian side, or coast of Oman. Soundings are to be got from side to side, and were the Straits sounded, it would be a great benefit to ships entering or leaving the Gulf in the night or in thick blowing weather.

The Persian Gulf is only partially surveyed. The chart we have of it is the result of a survey, part of which was trigonometrical; but those engaged in this part even, seldom landed,—they measured bases from ship to ship by

sound. And half the Gulf was what is called a "running survey,"* corrected by observations for latitude and longitude at every opportunity, and is therefore of about the same value as the "route surveys" on land, where much is left to the eye and to the judgment of the observer in estimating distances.

I would not be thought to disparage or overlook the merit of others. On the contrary I cannot but admire the skill and perseverance shewn by Maughan, Guy, Brucks, Rogers and others, of the Indian Navy, employed on this survey between the years 1821 and 1828. The charts of the Gulf were constructed with great taste and ability by Lieut. Houghton, I. N., who was a most accomplished draftsman. I am able to appreciate the efforts of men engaged in such a duty at a time when the facilities for its accomplishment were infinitely smaller than they are at the present moment.

A very short time before the Persian Gulf was being surveyed, its waters were infested by a piratical population, who in large numbers, hardened by constant success, and fearless from continued immunity from punishment, rendered the navigation of this sea unsafe for commercial purposes. It was our task to put them down, and it has been done effectually; but the execution of the task engendered feelings of hostility in the minds of the people inhabiting a large extent of the coast which was to be surveyed, and the difficulties of the survey were consequently increased. To have acquired anything like an intimate knowledge of the coast at that time was difficult and dangerous. The principal object of the survey was, to lay open the haunts of the pirates, and to ascertain how far our cruisers might pursue them without running on sunken rocks and shoals. It was probably considered that, owing to the jealous and hostile character of the natives, a superficial survey, as it was all that could well be obtained, so it might answer the main ends for which it was instituted.

There was another obstacle to making an accurate survey, and one of nearly universal application, which was the prejudice of the inhabitants against Christians at any time, but particularly when seen measuring the ground and setting up instruments. This awakened in their minds suspicions that there was an ulterior design, against them or their possessions, veiled under the guise of a scientific experiment.

The case is altered now to what it was in the time of the survey. An act of piracy is very rare in the Gulf. We are at peace with the whole population of the Persian and Arabian coasts, and our name is respected through

* *i, e,*—a survey hastily made in a ship whilst sailing along a coast. A gentleman passing through the country on the top of a stage coach, and surveying it as he went, would form nearly a parallel case.

their whole extent. Mussulman prejudices are permitted to slumber, or are altogether eradicated, and many are the instances which can now be enumerated of acts of hospitality enhanced by the noble simplicity and patriarchal habits of these people. The Nakhoodas of some of the Bagalows belonging to the principal ports of the Gulf have the E. I. Company's Chart on board, and know its value, and to a certain extent its imperfections.

Commerce, the most powerful link to connect nations of widely different character, is now carried on without hindrance, and the Persian Gulf is yearly assuming a more important character with reference to European politics; and I believe the Gulf is destined to become the highway from India to London.

With these considerations I have no hesitation in saying, that the existing charts of the Persian Gulf, reflecting as they do great credit on those who made them when the difficulties they had to overcome are taken into consideration, are nevertheless imperfect, incorrect, and insufficient for the requirements of the times.

During the years that I have devoted my attention to the hydrography of the Persian Gulf, I have lost no opportunity of procuring authentic information bearing on the errors and deficiencies of the charts; and here I shall enter upon a short general description of the Gulf, and then proceed to give a detailed account of some of the important errors, &c., in the charts.

The method I have followed is to describe the errors and deficiencies in succession, beginning at the entrance of the Gulf on the Persian side, and following the coast round until we arrive at Maskat.

I must here premise that I have never been employed in the Gulf in a surveying vessel. My knowledge has been acquired at various times and in various ways. It has been with me a task of research, and I may add one of pleasure, carried on without any assistance during the few leisure hours an officer finds in a cruiser; and latterly, when engaged surveying on the coast of Western India, I have still continued to avail myself of the leisure time which has fallen to me to continue these researches. Nothing but great perseverance has enabled me to learn so much about that Sea, and by indefatigable painstaking for many years, I have been enabled to detect, and to point out officially, a mass of inaccuracies.

The Persian Gulf is entered by a narrow strait called by the Arabs "The Lion's Mouth," where from either side the opposite coast is visible. After passing these, the shores of Persia and Arabia, receding, we find ourselves in a great inland sea, up to the head of which the distance is 500 miles—its

general width is 120 miles. This Gulf, unlike the Red Sea, which is in a deep narrow bed, is shallow. The only deep part of the Gulf is at its entrance, and here there is 100 fathoms of water; but this depth is only found close to the rocks at Cape Moosendom, it becomes less deep as you go out from the Cape. Within the Gulf, 50 fathoms is about the deepest water, and the upper portion is much shoaler. A peculiar feature of the Gulf is, that there is scarcely a good harbour in it. The Persian Coast is mountainous; the opposite, or Arabian coast, is mostly a low sandy desert shore. The former coast is the one most navigated, and is the safer of the two. The latter is shallow, and skirted by reefs and banks, in some places extending to a great distance from the land. This fact is a verification of Dr. Carter's statement, who, in his geography of the Coast of Arabia between Aden and Maskat, published in the 3rd vol. of the Journal of the Bombay Branch of the Royal Asiatic Society, describes a part of the coast between Maskat and Ras-el-Had, where the mountains are from 4000 to 6000 feet high near the sea, and that off that part there are no soundings to be got more than half a mile off shore; and adds that "on this coast as well as the S. E. coast of Arabia, it may be taken as a rule, that wherever the coast is low there the sea is shallow, and wherever it is high it is deep." The Persian Coast is the better known of the two. The Arab Coast is almost unknown; and I concur with the observation of the learned German, Professor Heeren, who, writing thirty years ago, in his chapter on the commerce of the Babylonians says, that "the coast from the Basra River to Cape Moosendom is one of the parts of our globe with which we are the least acquainted."

The great Gulf or Estuary outside the straits, having the Mekran coast on the north, and the shores of Oman on the south, is called the Gulf of Oman; it is not strictly speaking part of the Persian Gulf, but being the entrance to it, I have given as much attention to it as I have to the coasts and islands of the Gulf of Persia.

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The E. I. C. S. "Elphinstone," Commodore Carless, entering the Persian Gulf, standing along the coast to the southward of Ras Aysheer, about 5 or 6 miles from the shore, shoaled suddenly from 8 to 4 fathoms, and whilst bringing the vessel to the wind had a cast of 2¾ fathoms. Steering directly off shore on a S. W. course, carried 3 and 3¼ fathoms, for about three miles before the water began to deepen. From this it would appear that there is a bank extending 7 or 8 miles from this part of the Persian Coast, instead of 2 or 3 miles as laid down on the chart.

In reporting this discovery (in June 1848) the Commodore adds,—"As far as I have been able to judge, the coast from Bundur Abbas to Cape Jask has

been very imperfectly examined, and as this is the side of the straits which vessels always work along in preference to the Arabian, it is highly desirable that it should be minutely surveyed."

The E. I. C. S. "Coote," Lieut. John Grieve, in 1842 suddenly shoaled her water off Ras Aysheer. The ship tacked four hundred yards from the edge of the shoal, but the shore was five miles distant.

The E. I. C. surveying ship "Benares," Commander Brucks, in January 1829 sailed along this coast, carrying the single line of soundings which we see upon the chart. It has had no further examination. Ras el Khaur is the entrance point of the Persian Gulf; 3 fathoms is marked a mile off it, nothing outside of that! Horsburgh warns ships how they pass this point. For when it bore "N. by E. ½ E. the ship 'Phœnix' shoaled to 4 and 3½ fathoms on a bank, then 4 or 4½ miles off shore."

The E. I. C. S. "Clive," Captain Hawkins, in 1835 struck on a rock off the Great Tumb, not mentioned on the charts. This Captain Haines was dispatched to examine in the same year; he found a dangerous patch with 1¼ fathoms on it. His survey was not published. It did not embrace more than the S. W. corner of the Island, off which the rock was found.

I was informed by Captain Brucks that a spit extends off the north side of this island, on which side no soundings are marked.

The line of coast between Cape Bostanah and Lingar (a town fast rising into the most important commercial depôt on the Persian side) is altogether erroneous in its line of direction.

The island Nobflure is laid down from three to four miles too far north. This lying immediately in the fair track up and down the Gulf, is an error of great consequence. Between this island and Polior there is a bank, which is not marked on the chart. In May 1822 the E. I. C. S. "Ternate" steering between these islands, bound to Bassadore, when Polior bore N. 8° E., distant about two miles, had 6 fathoms, hard sand; steered E. S. E., and had 6½, 6½, 7, 7½, &c. By the chart there is 40 fathoms where the "Ternate" found these soundings.

The island of Inderabia will probably be found laid down nearly two miles north of its actual position. The E. I. C. Schooner "Constance," when under my command in 1851, very narrowly escaped shipwreck off this island on a sunken ledge of rock on the south side, not laid down on the chart. It afterwards occurred to me that from its situation many ships must have been imperilled by this danger; and I have ascertained from the log-book of the E. I. C. S. "Elphinstone," that on the 25th of January 1835, that vessel, in beating up the Gulf, tacked a mile distant from the centre of the Island, and after standing off for a short time struck on these rocks.

In this part of the Gulf there are several important landmarks, which the charts do not exhibit, viz,—Jebel Terrinjee, known to seamen as Charack Hill—it is situated 13 miles inland, is exceedingly high, and is seen over great portion of the southern part of the Gulf;—a remarkable notch in the mountains named after Captain J. H. Grubb, I. N., who surveyed Basadore harbour in 1822, which is used as a leading mark by vessels entering Basadore; —and the three Hummocks on the western end of Kishm, also used as marks for that harbour.

Between Ras Nabend and Shewar, in a small bay affording shelter in a N. Wester, is a fort and village called Bunder Khelat. This place was discovered by Lieutenant Rennie in the E. I. C Schooner "Constance" in 1846. The unsuspected existence of this little bay, is a startling proof of the utter inefficiency of that mode of examination called a "running survey."

The great sand bank called the Berdistan, lying in the direct route to Bushire, has probably extended during the last twenty years.

The E. I. C. Brig of war "Euphrates" grounded on it in 1851. In the report which her commander, Lieutenant Balfour, made of the circumstance to the Commodore, he said—"I consider this shoal (a small knoll of sand on which the brig had grounded) to be a patch not shewn on the chart, outlying from the end of the Berdistan, with a channel between. In crossing from Bahreyn, I saw a similar patch when in a position where we were clear of the limits of the Berdistan, as delineated on the charts."

Barn hill and Halilah hill, two great mountains, well known landmarks to all seamen up the Gulf, were observed by Commodore Brucks, twelve years after his survey, to be very erroneously placed; he accordingly issued a notification assigning them their true position.

A correct survey of Bushire harbour (the seaport of Persia) is much needed. The published plan, which was made in 1826, is of little use, one great fault being, that it is not carried far enough out from the town to the southward and westward. It affords no information of the nature of the bottom to be found in the channel leading to the anchorage. No latitude or longitude of any point is mentioned. The depth of water, as well as the form of the banks, is erroneous. The coast line itself is far from correct. And the navigator on seeking information in Horsburgh's Directory is merely informed that a pilot is necessary. There are excellent marks for the harbour, of course at present generally unknown. A correct survey would be invaluable to the vessels of the Gulf Squadron, as well as to all ships bound there.

There is no English marine survey of the Islands Karrack* and Korgo. Dalrymple published a plan of them from a French MS., dated 1787. There is a trigonometrical survey of the Island, which was made by Ensign W. Anderson,† B. E. Regiment, in 1839, on the scale of 6⅔ inches to a mile. It seems to be all that one could desire as a land survey, for on it every nulla, and even the great fissures in the rocks, may be traced. Korgo lies about two miles north of Karrack. It is a low sandy Island, very dangerous to approach, being surrounded by reefs extending to a great distance, on which the E. I. C. Brig of war "Euphrates" was very nearly lost in 1849, but, after being on the rocks for five days, was fortunately got afloat again. The E. I. C. Steamer "Hugh Lindsay" ran on the reef of Korgo, and several vessels having got close to these reefs, without being aware of their existence, have narrowly escaped a similar misfortune.

On the general chart, Karrack Island (Fort) is placed in Latitude 29° 15′ 45″ N., Longitude 50° 18′ 20″ E. On the separate chart, entitled "Part of the Coast of Persia, from Ras Tuloop to Bushire, by Brucks and Cogan, 1826," it is in Latitude, 29° 17′ 37″ N., and Longitude 50° 21′ 00″ E. The former is the correct Latitude.

We have no chart of the River (the Shat el Arab) from the sea to Basra. For this navigation we are entirely dependant on the Arab pilots, who reside on Karrack, and are subject to Persia.

At a meeting of the Royal Geographical Society (in 1851) Sir R. Murchison observed, with reference to the rapid increase of the delta of the Mesopotamian rivers, "that this phenomenon was attributable to the immense volume of mud and sand carried down by the Euphrates and its associated streams being deposited in so land locked a body of water as the Persian Gulf, in which, aided by the inset of the tide, the sediment is poured back, instead of being swept out by a boisterous open sea." With reference to this opinion I would remark, that from these causes the alterations in the bed of the sea will, in all probability, be found of corresponding magnitude to those observed in the delta, and that there must be generally, throughout the upper part of the Gulf, shoaler water, and more banks and shoals than existed when that part was surveyed in 1828.

Koyt (called Grane on the chart) is a town carrying on a very large trade. There is a shoal in the fair track to it, just to the northward of Khubbah island; not marked on the chart. The E. I. C. Schooner "Constance," Lieutenant Sedly, anchored upon it in July 1855.

In the unsurveyed portion, between Biddulph's Islands and the land, Lieut. Fullerton passed within a hundred yards of two reefs not on the chart. He

* Properly Kharig or Kharij.

† This officer together with Vans Agnew was murdered at the instigation of Dewan Moolraj at Mooltan, in April 1848.

was steering to the N. N. E. from Gunna, bound to Bushire, in the E. I. C. Schooner "Tigris" in 1854.

On the large scale chart, "sheet No. 4, Arabian side." there is a shoal to which the surveyors have affixed the name Abaa Saafa.* This shoal is not the Boo Safa, for that lies 13 miles to the E. S E. of the patch marked on this chart. There is a reef here,—so far they are correct; but the mistake is in the name, Boo Safa, being applied to what is evidently the Fasht Mulahamael† of the general chart. The Boo Safa is a very dangerous shoal. It is called Boosaa Saah on the general chart. The names engraved on the chart in the Arabian character are, throughout the Gulf, generally very correct, but the English orthography is very bad.

There is a shoal, not on the chart, 30 miles north of Bahreyn, and lying only 9 miles to the westward of the fair track to Bahreyn from Bushire. Two of the vessels of the Indian Navy have come upon it in their way, one from Bushire to Bahreyn, and the other from Bushire to Katiff. The first was the "Constance," Lieutenant Rennie, in April 1848, who had 3¾ fathoms on it. The next was the "Tigris," Lieutenant Fullerton, who anchored on it in November 1854. This vessel shoaled suddenly from 28 to 6 fathoms. A boat was sent from her to sound, and 3 fathoms was the least water on the part thus examined. Both officers agree in their observations, which place the shoal in lat. 27° 4′ N., and long. 50° 42′ E.

There is a separate plan of El Katiff Roads made in 1825, the incompleteness of which is obvious on its face. But here the jealousy of the people prevented the surveyors from making a more perfect survey. The "Euphrates" and "Tigris," two vessels of the Indian Naval squadron, were blockading this place in June and July 1851. The Commander of the former vessel wrote to me—"I found the plan of the Roads quite useless. We sailed over it day after day guided solely by the pilot. There is a channel under Ras Tanhora, marked on the chart, but it is not navigable one quarter of the way towards Katiff. The entrance to the channel used by the Katiff bagalows (not shewn at all on the charts) is seven miles south of it. Both the vessels grounded in moving down from the anchorage off Tanhoora to this channel."

About two miles to the southward of Katiff is the village and fort of Anich · it was to this place that the boats of the Gulf squadron went in November 1854 to destroy the pirates' bagalow, which they found there, hauled up and protected by a breast work of stones and sand bags. There was a round tower between the main land and the island Tirhoot, which fired at our boats. Neither Anich or this Tower are marked on the plan of Katiff Roads. No

* The correct name is Aboo Safa, generally contracted to Boo Safa. In the Gulf there are very many places having Aboo prefixed. Aboo Moosa or Boo Moosa, on the chart Bomosa. In the same way Aboo Shahr, Boo-Shehr, and by the English Bushire.

† Fasht, in the phraseology of the Persian Gulf, is a stony bank or reef.

information concerning the tides is given, which is the more to be regretted as they run strong at that place.

Between El Katiff and Bahreyn lies the great shoal called the Fasht el Yarron. It is not connected with Bahreyn island, for there is a channel between, called the Khaur el Bab, which enables vessels to sail from Katiff to Bahreyn harbour almost in a straight line, instead of going round outside the Yarron, which is double the distance. In April 1825 the E. I. C. 10 gun brig "Psyche," drawing 10 feet, passed through, and it is strange that, although this was the surveying vessel, the channel is not traced on the charts. At last, it would appear, that the knowledge of its existence was lost, until in 1854 and 55, when Lieutenant Fullerton in the "Tigris," drawing 12 feet, used it several times. This officer discovered an old ruined fort, built upon the Yarron shoal, which must be from 10 to 12 miles distant from the nearest land.

The Fasht el Yarron is composed of sand and stones, and is upwards of forty miles in circumference. The eastern edge lies further eastward than it is drawn on the chart, and as it turns in to the westward, forms the northern entrance point of the harbour of Bahreyn, and as that point projects more into the way of shipping than is generally supposed, this is an error of importance.

Captain Brucks himself informed me that the form of Bahreyn island is not correctly given. It is probably but an eye draught. He also informed me that the inlet to the south of it, Dooat Es Elwah, extends further in to the southward than is represented on the chart.

The E. I. C. S "Elphinstone," in company with H. M. Frigate "Endymion," were steering towards Maharag harbour in 1841. The ships anchored to the northward of a great reef, not marked on the charts, which appeared to extend from Bahreyn island to the south eastward as far as the eye could reach. From the "Elphinstone," at anchor in 3½ fathoms, Maharag bore N. 48° W., distant 9 miles.

This shoal lies in an unsurveyed part. Indeed, the great bay in which Bahreyn island lies was only partially surveyed.

An instance occurred early in the year 1851, which shews the want of accurate plans of the harbours and anchorages in the Gulf. The Resident at Bushire required the Commodore to send the squadron to Dohah, a town from which, it was said, that piratical boats had been equipped. The Commodore, after carefully consulting the chart, was compelled to ask the Resident where Dohah was situated. Colonel Hennell replied, that it was close to the town of El Biddah; for that port then three vessels of the Indian Navy sailed, and there, close to Bidda, we found a considerable, walled town, called Dohah. These towns are situated in a bay, the approaches to which are studded with reefs and very dangerous. As I commanded one of the vessels

on this occasion, I commenced a survey of that harbour on the scale of 5 inches to a mile, but could not complete it in consequence of being required to proceed on other duties.

We then proceeded down the Gutter Coast to Khaur el Udeid (Core Alladeid of the chart), and on the way found the small group of islets called Lassart to be laid down about three miles too far north.

Opposite to El Biddah a patch, with but nine feet water on it, was discovered by the surveyors, but its position was not determined by them further than by marking off a space of twenty miles, on which is written, "within this space there is a small shoal patch with 1½ fathoms on it."

Aboothubbee Roads has always been regarded as an unsafe anchorage to remain in, from the exposed position of a ship at anchor there, and the bad holding ground. A survey of this place on an adequate scale would shew that the shoal near the shore is not connected with the main, but that there is a safe anchorage inside of it for small vessels. The "Tigris," drawing about 12 feet, was at anchor in this channel in September 1855, in a position of perfect shelter, having the town within musket shot of her.

To the N. Eastward of Aboothubbee a reef skirts the coast for about thirty miles, but is not marked on the chart. Off Ras Hanyoura (Ras Ellora of the chart) it is said to project three miles from land. Here the E. I. C. S. "Elphinstone" struck upon it in 1837; she was in 6 fathoms water just before the accident occurred. The Arabs say that there is a passage for small craft between these reefs and the shore, and that their bagaras sometimes sail alongshore inside of them.

There are on this part of the coast several considerable creeks which were never examined. The first, distant 10 miles from Aboothubbee, is called Khaur el Grab, said to be the finest creek on the coast, and fit for vessels of 10 feet draught, but requires a pilot. The next (Khaur el Gorabee) is 24 miles from Aboothubbee, is a good creek, but not so good as one, two miles farther on, called Khaur el Gonafa, or Gonatha, in which boats of considerable size sometimes anchor. All these, and other smaller creeks, unite a little way inland in muddy swamps and backwater, surrounded by jungle. Such Arab boats as do take shelter in these creeks do not venture farther in than is necessary, for fear of being robbed by their wandering brethren, for they know the Bedouins to be, what a traveller of the sixteenth century said of them, "a perverse people, void of all goodness."

What has been said of the coast N. E. of Aboothubbee is from Arab information I can have no reason for doubting them. In May 1851 I was at Koomza, a town situated at the head of one of the many deep coves in the neighbourhood of Ras Moosendom, where the fishermen informed me of a sunken rock, lying some distance to the westward of the high island called

Towkhul, or Sowhyg. Lieutenant J. M. Guy, I. N., surveyed this part in 1821, and I knew by the chart that the water there was from 50 to 70 fathoms deep, and I confess that I doubted my informants, but these poor creatures had given such clear transit marks, that our boat found the patch the first time she tried for it. A strong current running out of the Gulf carried her off into deep water. We picked her up and worked to the westward. Next day dropped her to windward of the patch, when, guided by the Arabs' marks, she again came on it, and anchored in 9 feet.*

From Aboothubbee up to Ras el Khyma soundings have not been taken off from the coast to a sufficient distance. There is a narrow bank which lies parallel to the shore from nine to twelve miles off, which would be very useful to vessels off the coast at night if it were traced and laid down, but the coast is only sounded out to 5 and 6 fathoms, which is about four miles off.

The Battnah coast forms the southern shore of the Gulf of Oman. It is, as its name implies,† a low level coast, 185 miles in length. About ten miles west of Maskat, the hills fall back from the coast; here, therefore, commences the Battnah coast which ends at Dibbah (a small town 47 miles S. of Moosendom island), for here the hills are close to the sea again. Having sailed along the coast from Maskat, one cannot fail to remark the change in its character at this part. The Battnah coast, which was low and covered with date groves, and the plain of which has been gradually narrowing as the mountains neared the sea, is now changed for the rugged barren hills which rise precipitously from the sea, and thus continue to the Cape, in some places forming a grey, rugged, and furrowed wall, rising nearly 2000 feet. This is the eastern coast of the Roos al Jibal‡. The Battnah coast has been of late visited by the squadron, in consequence of the slave dealers landing their cargoes on it, to be marched over the narrow neck to the Arabian towns, whereby they have escaped the vigilance of the cruisers employed within the Gulf to intercept them. It has also been for a considerable period a scene of warfare between the Imam of Maskat and his vassals. It is known to be a fertile and well populated district. The existing chart, entitled "Battnah or Burka Coast," extends from Maskat to Core Culba,§ 170 miles. It is constructed from a "running survey," made in the same manner that nearly all original maritime surveys of newly explored lands have been made. It was executed between the 24th March and the 6th of April, 1828, in the E. I. C. S. "Discovery." Considering that a fortnight only was devoted to the survey of 170 miles of

* Notice of this rock was published in the "Bombay Government Gazette," 1831, page 937; and in the "Nautical Magazine" vol. 21, p. 44.

† Bat-ha, low lying, gravelly ground. A large open place.

‡ Not as on the chart "Ras el Jibbul," for that is in the singular, the Cape of the Mountain. The Arab name is in the plural, meaning a region of Capes and Mountains, which is exactly its character.

§ Properly, Khaur Kalbat, The Bitch's Creek.

coast, the chart can only be considered a hasty maritime *reconnoissance.* It would be unreasonable to expect that in that time the coast could have been sounded; and any information concerning the coast itself, the tides and currents, and winds and weather on it, would be quite out of the question.

I have the authority of the late Captain Brucks, who commanded the "Discovery," for stating that there exists a bank fifteen miles from the coast, in Lat. 24° 30′ N., which has never been examined.*

A shoal, apparently not more than one fathom water on it, was reported to have been seen from the E. I. C. S. "Coote" in August 1841, about a mile off Burka Island.

Having now taken a glance at the shores round to Maskat, I must go back into the Gulf to notice several banks, lying out in this sea, which are not marked on the charts.

They form no obstacle to navigation, but, were they inserted in the chart, would be very useful in giving a ship's position at night or in thick weather; as it is, they are only a cause of embarrassment to the navigator who strikes soundings on them.

One was discovered in the E. I. C. S. "Elphinstone," Lieutenant A. H. Gardner, in June 1849, lying 30 miles from the nearest land. A twelvemonth afterwards Lieutenant Tronson, in the E. I. C. Brig of war "Euphrates," anchored on it and sounded it. This officer reports the Latitude of the bank 26° 44′ 30″ N., Longitude 52° 33′ 20″ E., the diameter not to exceed 2½ miles; that the least water found was 17 fathoms, while the general depth of the sea around was 40 fathoms.

Lieutenant J. Stevens, commanding E. I. C. Brig of war "Tigris," in crossing from Sharga in 1845, discovered a bank on which he found 15 fathoms water, whilst 40 is the average depth thereabout. This bank bears about N. ½ W., distant 5 miles from Boo Moosa Island.

The same officer reported some extraordinary overfalls he met with, from thirty to forty miles N. Westward of the Island Seir Abooneid, such for instance as from 10 to 17 fathoms at a cast. The vessel was then on the edge of the Great Pearl Bank, where but very few soundings have been taken. It would be interesting to trace the edge of this bank, which passes about 10 miles N. of Hawkool Island, and runs to the eastward, midway between the Islands Surdy and Seir Abooneid, towards the Arabian Coast.

In 1844, the E. I. C. S. "Coote" was crossing from the Arabian Coast to Basadore, and passing the Great Tumb, she crossed over a sand bank in 14 fathoms, the Island then being about five miles to the westward of her. They

* All the old charts, those of the last century, placed a shoal there.

had 30 fathoms before and after this. The E. I. C. S. "Elphinstone," following astern of the "Coote," had similar soundings.

There is a bank about seven miles to the S. Eastward of Shusa. The E. I. C. S. "Mercury," in 1817, was standing out S. and S. ½ E. from the shore of Kishm Island, and shoaled rapidly from 39 fathoms to 19 when about six miles off shore, then the soundings increased again to 40 fathoms.

The ship "Cawdee Bux" was working up the Gulf in 1763; standing off on the starboard tack, when in Latitude 26° 25′ N., and somewhere south of the Island Busheab, the bottom was seen under the vessel. They tacked to the N. N. E., but did not sound until they had got a mile or two from the shoal, and then they had 24 fathoms, 30, 35, and 40.

The E. I. C. S. "Mercury" was working up the Gulf in April 1817, and standing off on the starboard tack, at 10 P. M., shoaled suddenly from 43 fathoms mud, to 16 and 15 hard sand; wore ship, and stood north, had 16 fathoms, 17, 17½, 18, 23, 30, 40, &c. By her log I should place the shoal in Latitude 26° 29′ N., and Longitude 53° 10′ E.

I consider that we have here evidence of two ships having come upon a shoal lying somewhere about twenty miles to the southward of Busheab. The first nearly a century ago, and the other near forty years ago. It cannot be said that the survey has disproved its existence, because the chart does not shew that any soundings were taken at that part.

## Concerning the Longitude.

H. M. Frigate "Fox," running ashore on the Island of Seir Abooneid in January 1846, was the means of bringing to general notice, errors which exist in the longitude of portions of the Gulf. This ship had left Bushire, and found the position of Seir Abooneid on the chart to be erroneous; the late Captain Carless, I. N., proceeded in a steamer, in 1846, provided with eight chronometers, by which it was proved that Basadore and Seir Abooneid were nearly correct with reference to Bombay, but that Bushire was 8 miles of longitude too far west. This error in the longitude between the southern and northern portions of the Gulf is to be accounted for by a circumstance known to very few, which is, that the longitude of Bushire, as determined by several hundred transit observations taken by Mr. Rich, Political Agent, and Captain Edgar of the ship "Kusrovee," was used as the primary meridian by the surveyors for one half of the Gulf, whereas Basadore, fixed by chronometric measurement from Bombay (which it has since been discovered was in those days placed 7 miles too far east), was used as the primary meridian for the other. Captain Carless subsequently, when Commodore in the Gulf in 1848, continued to measure meridian distances in the E. I. C. S. "Elphinstone."

It would be superfluous to dwell on the advantage of having the *relative* longitudes of all points in the Gulf accurately determined. (This is what navigation, requires—the *absolute* longitude is of secondary importance.) This will tend to insure the safety of the navigator, and will enable the commanders of vessels to avail themselves of the simple and decisive method of correcting the rates of their chronometers, by obtaining observations at different places where they may be calling, for it will sometimes happen that a vessel has not opportunity, or time, in port to obtain a rate, and if she had, it is preferable to employ the difference of longitude as the means of obtaining directly the *sea rates* of the chronometers.*

In the "Nautical Magazine," vol. 8th, or 3rd of new series, 1839, is Lieut. Raper's discussion of the longitudes of the principal maritime points of the globe. At page 267 it is stated; Lieutenant Brucks in 1822, and following years, surveyed the Gulf of Persia and the Mekran coast, and the longitudes are reckoned from Bombay Flag Staff in 72° 54′ 26″.

This is a mistake,—that longitude for Bombay Flag Staff is what was adopted in later years by Captain Haines for his surveys of the South East Coast of Arabia.

Bombay Flag Staff was considered, at the time of the Persian Gulf survey, to be in Longitude 72° 57′ 40″ E. Between the years 1821-5 Lieut. Guy, in the E. I. C. surveying ship "Discovery," with six chronometers, four of which generally performed well, measured the difference of longitude between Bombay Flag Staff and Maskat, then Basadore, Gunnum island, Sharga, Seir Abooneid, and Aboothubbee. Nearly all the rest of the shores and the islands depend upon Bushire, and, as before stated, the longitude of the Residency at Bushire was determined by the astronomical observations of Mr. Rich, who made it in 50° 51′ 30″ E. Captain Carless in 1847-8 made Bombay Flag Staff east of Bushire Residency Flag Staff 21° 59′ 19″, the sum 72° 50′ 49″† is the longitude of Bombay Flag Staff for all that part of the Gulf which depended on Bushire, and 72° 57′ 40″ is the longitude of Bombay Flag Staff for the entrance of the Gulf, and within it as far as Aboothubbee and Basadore.

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I have now to call attention to some errata and mistakes which have come under my observation; they relate mostly to the drafting and engraving of these charts, and are as follows :—

On the separate sheet, entitled "Coast of Arabia from Ras Goberhindee to Ras Soaote, by Brucks and Haines, 1828," the Latitude and Longitude of the Islet called "Omal Pherrim" is given 25° 10′ 2″ N., and 56° 55′ 56″

* Vide, Raper's Practice of Navigation. London, 1854. Page 339.
† The Longitude of Bombay Flag Staff as lately settled is 72° 50′ 32″ East.

E. The true position, as shewn in the general chart of the Persian Gulf, is Latitude 26° 10′ N., and Longitude 56° 36′ 56″ E.

There is a serious mistake in the scale attached to this plan—it is double the size it should be. For 1, 2, 3, 4 miles &c., read 2, 4, 6, 8 miles.

On the separate chart, entitled "The Entrance of the Gulf of Persia, and Coast of Arabia, from Ras Goberhindee to Muskat, by Brucks and Haines, in 1828," the degrees of longitude are divided into 72 miles each.

On the general chart the neck of land, in Latitude 26° 26′ N., and Longitude 56° 32′ E., dividing Dooat Sheesah from the bay on the north, is made two miles wide, whereas it is but two hundred yards.

The Persian Gulf chart is very neatly engraved, but it exhibits a want of system in hydrographic delineation. For instance, the style of drawing sand hills and rocky mountains, banks of sand and reefs of rocks, is one and the same. The Persian Coast being mountainous, a row of hills has been put in from one end to the other, but not based upon actual observations, and consequently this immense tract of mountains merely serves the purpose of giving a mountainous effect to the Persian Coast. The mountains, as a general rule, lie in parallel ridges from two to four thousand feet high. Arid, mostly precipitous, and rent by deep ravines, they have a wild and desolate appearance.

Near Cheroo there is a maritime plain on the chart five miles wide, whereas the mountains rise precipitously out of the water.

The want of a good Guide-Book for the Persian Gulf is much felt. In addition to the nautical directions, it should describe the watering places, which are tolerably numerous on the Persian Coast, and also what places can afford supplies to vessels requiring the same. Correct information relative to the tides is also greatly needed. Officers possessing much local experience are subject to the same amount of embarrassment from this cause, as an utter stranger would feel. On the Arabian side, in particular, very little is known concerning the tides. A stranger would, I think, naturally suppose that the flood tide would flow up the shores of the Gulf from the ocean, but such is not the case. From Basadore up to Tahrie it has been observed that the flood sets down from the north, and on the Arabian side the same, but as yet it is only at one or two points that any observations have been made. When the E. I. C. S. "Coote" was lying aground on the north end of the Yarron shoal in 1829, it was observed that the flood tide ran past the ship to the southward, and in 1851, when the E. I. C. Schooner "Constance" was aground on the Fasht el Arreif, the flood tide there was observed to run likewise. The Arabs state that about Cape Moosendom there is occasionally an alternate ebb and flow, each of twelve hours duration.

An account of the prevalent winds and the weather throughout the year in the Gulf of Oman, lower portion, and upper part of the Gulf of Persia, and on the Arabian side, is a desideratum.

The Arab boatmen and pilots in some localities are guided very materially by the nature of the bottom, with the peculiarities of which we have not much knowledge. The pilots for the Basra River, the mouth of which is fronted by dangerous shoals extending for miles out of sight of land, are entirely guided by the specimens brought up by the lead; these they examine minutely at every cast.

There are more towns and villages along the shores of the Gulf than the charts shew; many have been built since the survey, and those which were then visited have much increased in size and importance with the increase of trade which followed on the suppression, by the British Government, of piracy.

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In conclusion, I have only to add, that in conceding to the wishes of the Geographical Society to place this Memoir at their disposal, for insertion in their printed Transactions, I trust my so doing will be viewed strictly in the light of a desire to benefit the cause of science, and adding a mite to the stock of geographical information already possessed by this Society. The subject is not a new one; the errors and deficiencies in the chart of the Persian Gulf have been long known, and ably discussed, in England as well as in India; and had it not been that the more important surveys of the Coast of Western India have so long occupied the whole staff of the survey department, there is little doubt the Gulf would have been re-surveyed before this. The present chart is in one sense quite sufficient to navigate by, and is, perhaps, equal to many of the surveys of that time; but as each defect or omission has come to light, the confidence of navigators in the chart has been shaken. This however is not to be wondered at, for, as the great hydrographer, Rear Admiral W. H. Smyth, states in his work—*The Mediterranean*—"hydrography is peculiarly a progressive science, and as such has always been so incomplete as to demand a continual correction of its errors. Nothing, therefore, can be more unjust or unsound than for geographers to condemn unsparingly the labours of their predecessors, without adverting to the circumstances, *pro et con*, in the history of each case." For my part, I have kept this uppermost in my mind, and would be sorry indeed to have it supposed for a moment, that my self-imposed task of collecting all the known dangers omitted in the Persian Gulf chart, was with a view to call in question the abilities of my predecessors, or to throw a slur on the result of their labours. For, as I before explained, the difficulties they had to contend with were no small ones.

# APPENDIX.

If I take a cursory glance at some ruins of old places along the Persian and Arabian Coasts of the Gulf, it will be seen that there is much that might well excite the curiosity of the antiquary and historian to investigate these interesting shores.

The ruins of Gerra or Gerrha, the great ancient emporium of the Persian Gulf, perhaps the most famous emporium of antiquity, are situated at the inmost recess of the deep and narrow bay, at the mouth of which are situated the islands of Bahreyn.*

About four miles south of Bushire, on the edge of the sea cliff, are the mounds of Risher, encircled by a wide and deep ditch. The Persian geographer, Hamdallah Cazvini, who wrote in the fourteenth century, dates its foundation above 500 years B. C. At Risher, earthen urns have been dug up, of the same description as those found in the banks of the Tigris. Sepulchral urns have also been found at Bushire

At Tahrie, on the Persian Coast, in Latitude 27° 39′ N., are very extensive ruins and sculptures, with the Persepolitan character.† These ruins were visited and described by Lieutenant Kempthorne, I. N., who suggests that they may be the ruins of Siraf.‡ In 1811 some officers of the "Elphinstone" sounded one of the wells there; it was 222 feet deep, with 78 feet water in it, and cut through the rock.

Siraf was a considerable port and seat of commerce during the 9th and 10th centuries,§ and it seems, in that early age, carried on a trade with China. Tahrie may be the ancient Siraf, but I should look for the remains of Siraf at, or near, Charack, or near Jilla el Abed (Jilla Abade of the chart.)

Khais, Keish, or Kese (Kenn of the chart) was a flourishing city in the thirteenth century.‖ All the islands in the Gulf belonged to it. Harmozia was the appellation of a state situated on the northern shore of the Gulf, the inhabitants of which, when the Moguls invaded their country in the thirteenth century, determined on quitting the main land, and having obtained a grant of the desert island, then called Gerun, from the King of Khais, they removed thither and gave it the name of the country they had quitted. These settlers on the new Hormuz, or Ormuz, became so powerful, that in 1330 they con-

* Historical Geography of Arabia; by the Rev. C. Foster, B. D.

† Morier's First Journey. London, 1812.

‡ Vide Transactions of the Bombay Geographical Society, vol. 1st, p. 294.

§ Trade of Siraf. See the Oriental Geography of Ebn Haukal. Translated by Sir William Ouseley.

‖ Vincent's Perriplus, p. 476.

quered Kese.* The ruins of the town on Gese are to be seen on the north side of the island. The Arabs call the place Harrecrah. The principal remains are those of a well built minaret, about 30 feet of which is standing, with a spiral stair within, and the cisterns or reservoirs, some of which are under ground, and of extraordinary dimensions. A rough plan of this island was made by Lieutenant Grubb in 1822, where these ruins are marked as those of a Portuguese town. Ruins seen on these shores were commonly called Portuguese,—probably from inquiry of the natives,—for the Arabs attribute every old building, of the history of which they are ignorant, to the Fringis.

Dean Vincent says, the bare mention of Ormuz is sufficient to attract our notice to the celebrated emporium of that name established on the isle of Gerun, which was such a rich and flourishing city in the fourteenth and fifteenth centuries. The Portuguese took it in 1507, and the Persians, assisted by four English East Indiamen, took it from them in 1622.†

There is a ruined city a little inland of Linga, which was visited in 1694 by Gemelli Careri, who was at that time staying at the Portuguese settlement Congo. He says, "we went out three miles from the town westward, and three from the sea, to see an ancient fort called Calalesion, or rather a strong city once built by a King of Persia, on the top of a high rock. It is three miles in compass, and there is but one narrow steep way to come to it; there is not a house standing at present, time having overthrown them all. There are still to be seen the tombs of the Mahomedans, and a ruined mosque; but nothing more proves its ancient splendor, than 300 good and large cisterns, most of which are full of earth and few of water."‡

Between Maskat and Ras el Had is Kalhat, described by the Arabian geographers to be a populous city, situated on the top of a mountain.§ The Portuguese described it, as being, in 1507, "a beautiful place, built after the manner usual in Spain." However, they plundered and burned it a year afterwards.||

Sohar is the principal town on the Battnah coast. Edrisi, who wrote in the year 1153, says, that "Sohar is the ancientest citie of Oman, sometime the port for the China ships, which now is ceased because of the iland of Kis," &c. So runs the translation in *Purchas*.

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* History of Persia and Ormuz. Translated into Spanish by Teixeira, and into English by Stevens.

† Purchas his Pilgrimes. vol. 2nd.

‡ Voyage round the world; by Dr. John Francis Gemelli Careri.—Churchill's Collection of Voyages.

§ See the Travels of Ibn Batuta; by the Rev. S. Lee, B. D. p. 61.

|| The Portuguese Asia of Manuel de Faria y Sousa.

To those who are engaged in the study of the ancient history of Arabia, it may not be uninteresting that among the inlets about Ras Moosendom, on the Arabian side of the Persian Gulf, the largest and most remarkable, from its sheltered and concealed position, is called the Khaur es Shem (the Bay of Shem), in which there is also a village and an island called Shem respectively, added to which, at the further extremity of the bay, there is another village called Sebee. This bay on the charts goes by the name of Elphinstone's Inlet, and is about 12 miles from the cape itself, which is called by Ptolemy Promontorium Assaborum, or the Promontory of the Sabians, and the mountainous ridge of which it is a continuation, the Montes Assaborum. Not far from this, I was informed by the inhabitants that there were stones up a valley among the mountains (so well as I could judge about fifteen miles from the shore), which were covered with written characters. This was at Kasab, where there is a fort and a fertile valley, with abundance of fresh water; and it does not seem to me improbable, that when the trade between India and the western nations was carried on through the Straits of Bab-el-Mandeb, as well as through the Straits of the Persian Gulf, there was the same kind of toll placed upon traders here, and taxation of the interchanged goods, as anciently at Aden. There are also the remains of a fort on Ras Moosendom itself, which is an island about two miles long; these remains consist of blocks of stone, squared with too much care to have been of modern origin, and therefore might be the remains of a building which anciently served as a watch tower.

# APPENDIX A.

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## METEOROLOGY.

The following is the list of Storms adverted to at page xxxiii. I had hoped to have been able to have made it much more perfect than it is. While it may be regarded, so far as the Arabian Sea and Bay of Bengal are concerned, tolerably perfect for twenty six years back—or even as respects the China Seas as far East as Canton,—in reference to the Cape, Mauritius, and other places South of the Line, it is of no value whatever. Of the sixty-one hurricanes which have occurred in the quarter first named from 1830 to 1854, the following is the proportions for each month in the year :—

| | | | |
|---|---|---|---|
| January | 0 | July | 4 |
| February | 0 | August | 5 |
| March | 1 | September | 8 |
| April | 5 | October | 12 |
| May | 9 | November | 9 |
| June | 2 | December | 5 |

The following gives the numbers for each of the years just named:—

| | | | |
|---|---|---|---|
| 1830 | 0 | 1843 | 0 |
| 1831 | 2 | 1844 | 0 |
| 1832 | 6 | 1845 | 4 |
| 1833 | 4 | 1846 | 1 |
| 1834 | 0 | 1847 | 1 |
| 1835 | 1 | 1848 | 2 |
| 1836 | 2 | 1849 | 2 |
| 1837 | 2 | 1850 | 1 |
| 1838 | 0 | 1851 | 1 |
| 1839 | 3 | 1852 | 2 |
| 1840 | 4 | 1853 | 2 |
| 1841 | 1 | 1854 | 5 |
| 1842 | 6 | | |

1648. May 16. (27th present reckoning.) A furious hurricane prevailed from Bombay northward, accompanied by an earthquake.

1737. October 7. A violent earthquake and furious hurricane at the mouth of the Ganges, which reached sixty miles up the river—20,000 craft of all descriptions destroyed ; eight English ships, with most of their crews, lost in the Ganges—300,000 people said to have perished in Lower Bengal or in the Gulf ; the river rose 40 feet above its usual level. An English church and steeple sunk into the earth next morning.

1746. December 6. Six French men-of-war blown out of Madras Roads by a hurricane : one of these foundered ; four were dismasted ; twenty other vessels either driven ashore or lost at sea ;—the storm not so much as felt at Pondicherry.

1774. April 13. A furious hurricane set in on the Coromandel Coast just as the English were about to march on Tanjore : the camp blown down, the tents torn into rags. Two Indiamen stranded : the Apollo, hospital ship, the Bentinck 60 guns, and Nanur, 74, lost, with nearly all on board.

1780. July. Typhoon in China Seas, a hundred thousand people supposed to have been drowned.—*P. M.*, 1842.*

1782. April. In the Gulf of Cambay accompanied by a dreadful inundation.—*As. Jl.*, vol. xviii, p. 106.

1788. November 3—7. Violent hurricane from Tellicherry north to Bombay; great loss of shipping and lives—proving fatal to almost every ship within its reach.

1787. May 19. In upper part of the Bay of Bengal; inundation at Coringa, sea rose nearly fifteen feet: 20,000 people and 500,000 cattle supposed to have perished.—*H. B.*, p. 171.

1789. In the N. W. part of the Bay of Bengal, three enormous waves, following in slow succession, deluged Coringa, the third of them sweeping every thing before it.

1790. In the China Seas.—*P. M.*, 1844.

1792 October 26—27. Madras.

1797. June 18—20. Madras.—*P. M.*, 1842.

1799 November 3—7. Frightful hurricane from Calicut north. H. M. Ship Resolution with about 100 small craft and 400 lives lost in Bombay harbour.

1800. October 19. Furious hurricane and earthquake at Ongole, and so round by Masulipatam.

1800. October 28. Hurricane at Coringa and Masulipatam.

1803. September 20—28. China Seas, 20 N., 117 E.—*P. M.*, 1842.

1805. January 7. Trincomallee, Coromandel Coast, and so across to Tellicherry on the Malabar Coast.—*As. An. Register*, 1808.

1805. March 16. Calcutta and Lower Bengal.

1807. June 24. Furious hurricane off Mangalore.—*As. An. Register*, p. 171.

1807 December 10. Madras.

1808. December 12. Madras and Southern Coromandel Coast—great loss of life and shipping.

1808 November. The London, Nelson, Experiment, and Glory, East Indiamen, parted from the fleet, and never more heard of: supposed to have gone down in a hurricane, and all hands perished.—*Milborne's Oriental Commerce.*

1809. March. Duchess of Gordon, Calcutta, Bengal, and Lady Jane Dundas, parted from the fleet in a hurricane, and supposed to have foundered; all hands perished.—*Ibid.*

1809. March 28—30. China Seas.—*P. M.*, 1842.

1810. September 20—30 China Seas, 17 N., 115 E.*

1811. April 30. Madras. Destroyed nearly every vessel in the roads—90 native vessels wrecked at their anchors; the Dover, frigate, and store ship Manchester, run ashore and were wrecked.

1812. September 8—10. China Seas, 16 N., 114 E.

1816. July 10. Singapore—200 lives lost.

1816 Malacca, thirty houses blown into the sea, thirty or forty vessels lost, and at least 400 people drowned.—*As. Jl*, 1817, vol. iii., p. 409.

1818. October 23—24. Madras: severe revolving gale.—*As. Jl.*, May 181[illegible], vol. vii, p. 558.

1818. October 24. Madras: centre passed right over the town—fearfully destructive.

1819. Mauritius (no particulars.) Rain fell for thirty hours continuously, and swamped the whole country.

1819. September 25. Cutch and Kattiwar, lasted a day and two nights.—*As. Jl.*, 1820, vol. ix., p. 307. (?)†

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* As a very large number of the Storms in the above list are taken from Mr Piddington's Memoirs, in the Transactions of the Bengal Asiatic Society, or the Horn Book of Storms, we have placed *P. M.* after the date of the former, and *H. B.* after the latter.

† A point of interrogation indicates a doubt as to whether or not the gale was a true cyclone.

1819 October 28—29. China Seas, 89 N., 119 E.

1820. March 29 and 30. Madras.

1820. May 8. Madras, two square rigged vessels wrecked and an immense quantity of native craft—stretched across to the Arabian Sea, and occasioned some loss of shipping southward of Bombay.

1820. November 29. China Seas, 12 N., 109 E.

1820. December 2. Madras, Pondicherry, and Coromandel Coast.—*As. Jl.*, vol. xi.

1821. October. China Seas.

1822. June. Mouth of Ganges and Berhamputra: storm travelled at the rate of about 2 miles an hour, 53 miles in 24 hours. 50,000 people perished in the inundation.—*H. B.*, p. 73.

1822. September 14—15. China Seas, 20 N., 114 E.

1823. June 2. Chittagong and Delta of the Ganges.

1823. May 26. Violent hurricane in the Bay of Bengal; six large English ships wrecked.

1824. February. The Mauritius: very severe. H. M. S. Delight, with 120 slaves, wrecked.

1824. June 8. Chittagong: heavy inundations. (?)

1826. September 27 China Seas.

1827. October 26—27. China Seas, 9 N., 118 E.

1827. December 20. Bombay.

1828. December. Mauritius.

1829. August 6. China Seas, 18 N., 114 E.

1830 March 27 and 3rd April. Bourbon—did not reach the Mauritius—*As. Jl.*

1831. September 23. China Seas.

1831. October 22—23. Manilla—4000 houses destroyed. Barometer fell from 29 90 to 28 70.

1831. October 31. Lower Bengal, inundations swept away 300 villages and at least 11,000 people, famine followed, and the loss of life is estimated at 50,000.—*As. Jl.*, vol. viii., p 18, 1832 ; and vol xii , p. 162, 1833.

1831. December 6 Pondicherry and Cuddalore, of few hours' duration only, but fearfully destructive.

1832. May 21. Delta of Ganges, eight to ten thousand people drowned.

1832. August 3. China Seas.

1832. August 4. Furious hurricane at Calcutta. Barometer 28 8.

1832 September 23. Macao, China,—100 fishing boats lost; of cotton alone 1405 bales picked up.

1832 October 8. Furious storm and disastrous inundation at and around Calcutta: great sufferings in consequence at Balasore. Barometer fell from 29 70 to 27·80 in sixteen hours.—*P. M.*

1832. October 22 and November 8. China Seas.

1833 May 21. Tremendous hurricane off the mouth of the Hooghly. Barometer fell from 29.090 at 8 A. M. to 26 5 at noon.

1833. August 26—29. China Seas, 22 N., 113 E.

1833 October 12—14. China Seas, 16 N., 117 E.

1833. November 29 and 30. Ceylon, violent fall of rain and disastrous river inundation.

1835. August 6—8. China Seas.

1836. July 31. China Seas. £250,000 lost by shipwreck.

1836. October 30. Madras—did enormous mischief on shore. Barometer sunk to 27.8. Centre passed over the town.

1837. June 15. A tremendous hurricane swept over Bombay: an immense destruction of property and loss of shipping in the harbour, estimated at nine and a half lakhs, (£90,000); upwards of 400 native houses destroyed.

1837. November 16—22. China Seas, 15 N, 116 E.

1839. June. In the Bay of Bengal, and off Coringa.

1839. November. Off Coringa and Madras. A storm wave lays the shore 8 feet under water—70 vessels and 700 people lost at sea, 6000 said to have been drowned on shore.

1839. October 7—10. China Seas.

1840. November 28—30. China Seas.

1840. April 27 and May 1. Violent in the Bay of Bengal.

1840. May. Hurricane off Madras and the southern coast.

1840. September 24—27. In the China Sea, in which the Golcondah, with a detachment of the 37th M. N. I., 200 strong, on board, is supposed to have been lost.

1841. May 16. Madras, great loss of shipping.

1842. September. China Seas.—*H. B*, p. 243.

1842. May. Dreadful storm prevailed in Calcutta on the 3rd and 4th, by which every ship, boat, and house, was more or less injured.—*H. B.*

1842. June 1, 2, and 3. A frightful hurricane visits Calcutta, injuring almost every vessel in the river, and house in the town and neighbourhood. The barometer attains the unprecedented depression of 28 278.

1842. October 5—6. Hurricanes betwixt Cuttack and Pooree.

1842. October 22. Severe hurricane over Madras, and across the Arabian Sea, as far as Aden.

1842. November 1. In the Arabian Sea.

1843 April 20. Hurricane at the Mauritius, nine vessels driven into Port Louis more or less injured.

1845. February 22—27. Violent hurricanes at the Mauritius.

1845. November 27—28. Two hurricanes in the China Seas occurred to the North and South of the Line, almost simultaneously, 13 degrees apart.—*H. B*, 28.

1845. Bay of Bengal.—*H. B.*, 239.

1846. November 25—26. Violent hurricane at Madras, and so across to Mangalore and Cochin.

1847. April 19 Terrific hurricane from the Line north to Scinde, in which the H. C. S. Cleopatra is lost, with 150 souls on board. The Maldive Islands submerged, and severe want and general famine ensues.

1848. April 23. Violent hurricane off Ceylon, in which H. M.'s brig Jumna, from Bombay, where she had been built, was nearly lost; she had an obelisk, and other most valuable Assyrian marbles on board.

1848. September 12—14. Violent hurricanes in the Bay of Bengal.

1849. July 22-26. A violent storm and rain burst all over India; a hurricane swept the Jullundhur, carrying every thing before it. The barracks of H M. 32nd, at Meerut, and those at Ghazeepore, were destroyed. On the 25th, 10 inches of rain fell at Bombay, and in the course of four days 26 inches fell at Phoonda Ghaut, and 40 inches at Mahableshwar (?)

1849. December 10. Severe hurricane at Madras; the ships Lady Sale, Industry, and Princess Royal, lost.

1850. December 4. Hurricane at Madras, two European ships and eighteen country craft wrecked.

1851. May 1. A furious hurricane raged off Ceylon; a second prevailed at Madras on the 6th, sweeping across the peninsula, and sending up a tremendous swell towards Sinde. The ship Charles Forbes, of Bombay, lost in the Straits of Malacca.

1851. October 20. The hurricane which visited Calcutta, and its neighbourhood on the 22d and 23rd October, did great damage to the shipping off Diamond Harbour and below Saugor. Two vessels—the Bengalee, outward bound, and the Scourfield, inward bound,—were wrecked; the former on Saugor Island, and the latter near Point Palmyras—crews of both vessels saved.

1852. May 14. A terrific hurricane burst over Calcutta—barometer 29 362—more severe than any that had been experienced since 3rd June 1842, when the barometer sunk to 28·278, the lowest ever known in Calcutta, and almost every vessel in the river, and dwelling house on shore, was more or less injured. During the gale there were destroyed in Calcutta 2,657 thatched and 526 tiled houses, with 40 substantial buildings—eleven persons were killed, and two wounded. On the 8th August 1842, the barometer at Calcutta fell during a hurricane to 28·800.

1852. May 17. A severe gale experienced at the Cape—barometer fell to 29·42 (T 60), the lowest known since 21st April 1843, when without any change in the weather being experienced, it sunk to 29 38, the lowest on record at Cape Town.

1852. December 16. Very violent at Macao, scarcely felt at Hongkong, from Canton all along the North Coast of China.

1853. March 26—28. Furious hurricane all over Southern India; some fifty vessels sunk or wrecked on the Coromandel Coast to the southward of Madras.

1853 October 10. Hurricane in the China Seas, large steamer dismasted and narrowly escaped shipwreck betwixt Hongkong and Singapore.

1854. April 10—12. A tornado swept lower Bengal from W. S. W. to E. N. E, sweeping villages and great trees before it, and destroying it is said 300 people.

1854. April 21—23. A violent hurricane at Rangoon, 25 boats with the Head Quarters of the 30th M. N. I. wrecked in the Irrawady—the Barracks on shore unroofed.

1854. May 22—24. Hurricane in the China Seas—the P. and O. Co.'s Steamer Douro lost her funnel, and was driven ashore a wreck.

1854. September 27. A severe hurricane in the China Seas, 19 N., 117 E.

1854. October 6. Hurricane south of Ceylon.

1854. November 2. Hurricane at Bombay—a thousand human beings and half a million worth of property supposed to have perished in four hours' time.

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## APPENDIX B.

EXTRACTS.—As a great deal of valuable scientific information is occasionally to be found scattered about through our local periodicals and newspapers; which is apt in a few years to be lost sight of in India, it has been deemed expedient to republish a selection of the most interesting of these in the shape of an Appendix, as this when carefully indexed, will avoid the risks hitherto suffered from.

A RAINY DAY IN THE RED SEA—and what of it says the general reader? "Why not a rainy day in the Red Sea as well as any where else?" Why not to be sure! This is a question we shall not attempt to answer, only the event about to be adverted to is one of the rarest that can be imagined. It must be somewhat hard for the English, still more so for the Bombay reader, to imagine the existence of districts where rain so rarely falls that they are set down in the map as rainless—yet there are many such on the globe, and one such is the district from the borders of Cutch southward and westward by the entrance of the Red Sea, and so on to the shores of the Mediterranean, including the southern portion of Arabia, and the north eastern shoulder of Africa. On the 26th and 27th of July 1854, a sand storm prevailed in the Red Sea betwixt the 18th and 26th parallels, or from near the Gulf of Suez to within a hundred miles of Gibbel Teer. The air was red and lurid and heavily loaded with sand, so that the decks, sails, and rigging of the steamer were thickly covered by it, the nearest land in the direction in which the wind was blowing was good seventy miles away. The heat was most oppressive, the thermometer rising as high as 92. At night there was lightning and thunder with some showers of rain, and from the morning of Friday the 28th to the evening of Saturday, it rained almost incessantly betwixt the 13th and 16th parallels, for to this space it was confined. How far to the eastward or westward it

extended did not appear. The steamer *Ganges* passed through the rainy region, on part of Thursday and Friday in the same place where it was experienced by the *Victoria* on Saturday, the same general appearance being manifested to both on the two consecutive days; in both cases it cleared up as the volcanic region was approached in latitude 15 30. Two rain gauges were put up on board the *Victoria*, and though they could not be managed so as to be made very trustworthy, as both gave nearly the same results, they were in all likelihood not far from the truth. They indicated a fall of an inch and a half in eight hours, the total fall probably amounting to about double this. During the rain the thermometer fell from 92 to 86; the sea all the while continuing at 88, or three degrees higher than it had been during the previous dust storm—leaning over the gangway one felt as if a steaming cauldron had been beneath. After the rain, the air exhibited that extraordinary transparency so rarely met with in arid countries where light is transmitted so imperfectly and irregularly. The shores of Africa and Arabia and the mountains far inland on the opposite shore of the sea were seen at once, some among the most conspicuous of the latter being at least a hundred and twenty miles from the spectator, the eye sweeping a circuit of above 250 miles in diameter. The beauty of the numerous volcanic groups of islands, but more especially of the shores around Mocha, was something quite indescribable. Near the Straits it was found that the temperature of the Sea had sunk to 79, that is to nine degrees lower than it had been 24 hours before. Here long bands and trails of discolored matter, floating on the surface of the water, were visible, such as is usually described as fish spawn. They smelt like new cut-hay, and on specimens being taken up and examined by a magnifier, they astonished the observer by turning out to be the seeds and flowers of grass. The Arab Pilot, a very intelligent man, without being beforehand informed of the fact, was catechized on this subject, and described them as being what they actually turned out to be. The muddy creeks and shores he said abounded with grass, the pollen or seed of which, a rough sea or an unusually high-tide floated away, the wind drifting it for leagues out to sea. That collected in a handkerchief was found to yield a fine crimson-colored dye, that filtered through paper became bright green; the anthers and the formed seeds, the latter very small in size, were almost equally abundant. This is not to be confounded with the coloring matter so often observed, not floating on the surface, but diffused through the water, and which is assuredly either spawn, vegetables, or animalcules, or probably at times all the three. The profusion of the red color towards the Gulf of Suez is believed by Ehrenberg, and in all likelihood correctly, to have secured for the sea its name. A sheet of a milky, or sometimes of a snowy hue, extending over about four square degrees of surface is generally observed betwixt the 15th parallel and the mouth of the Persian Gulf. Singular to relate, though our ships have been passing through this region every month or fortnight for the past twenty years, most of them with a medical man on board, we are up to this moment in total ignorance of the cause of a phenomenon so remarkable. An Earthquake was experienced at Nattore in Lower Bengal on the morning of the 26th; a second at Midnapore on the morning of the 27th; a third at the same station as well as at Kurrachee in Lower Sinde at 6 A. M. on the 29th—an instance of what so often occurs of Volcanic and Meteorological disturbances happening together. Violent rain fell on these days all over the North West Provinces, and there were showers, though this is their fair season, at Madras.—*Bombay Times*, 1854..—*Dr. Buist.*

We take the following from the *Jugamitra* of the 7th instant:—RAIN OF PEARLS—"On the 26th of July last in the Anjunwell Talooka in Rutnagherry, rain of Pearls fell for about two hours on a spot of ground twenty cubits long by twenty broad. The old as well as the young inhabitants of this place form various imaginations regarding this miracle. They say, this kind of rain indicates a revolution in the British rule, and this notion may have been suggested

by the present war with Russia. Some of these pearls could be seen in the Jugamitra office. They appear to be somewhat of the color of real pearls and of a very small size, but are light and brittle. A shower similar to this took place in the Concan some seven years ago—specimens of the so called pearls were sent to us and proved to be the eggs of insects dropped in the course of their flight, and we have no doubt the same will once more be found to be the case.—*Bombay Times.*

FORMER CLIMATE OF SINDE.—The investigations of Mr. Bellasis into the antiquities of the ruined city of Brahminabad have brought to light a multitude of matters bearing on many points, besides those connected with Archæology, of the last degree of interest. The city along with many others of note, is situated about fifty miles east of the Indus, towards the bank of what must then have been the principal channel of the stream where it debouched at Luckput, and which now forms the Eastern Narra with its dry channel, its strings of lakes or dhunds. Brahminabad is mentioned in the early histories of Sinde as having been a large and flourishing city about the eighth century of our era; and as it is no where noticed later than this, it is supposed to have been overthrown by an earthquake some thousand years ago. It is surrounded by a wall regularly provided with gates and towers and four miles in circuit, affording ample space for a population of a hundred thousand. Skeletons are found scattered all through the buildings as if crushed under the ruins occasioned by the great catastrophe. The walls and houses are all of well burnt brick, a matter specially deserving of attention. In nearly rainless districts, such as Sinde, Egypt, and part of Belochistan have long been, the expensive operation of burning bricks is never thought of where it can be dispensed with; and we are fully warranted to infer that a thousand years ago, when a precaution was found indispensable which is now superfluous, Sinde was blessed with regular falls of rain. We have frequently urged the probability that this state of things might be brought back again by human means, and that were plantations of timber extended and cultivation pushed through the instrumentality of irrigation, Sinde might speedily become as moist as the adjoining provinces of Cutch and Kattiawar, which enjoy falls of rain of from twenty to thirty inches, or equal to that of the Deccan. A system of cultivation which should effect a climatic change to this extent over an area of a hundred thousand square miles of rich alluvium, would mark an era and be worthy of the name of improvement;—make the wilderness and the solitary place blossom as the rose. Yet the likelihood that the thing is possible is eminently strong, and it is perfectly certain that the attempt, even if unsuccessful, would be enormously lucrative. A thousand years ago glass and glazed earthenware abounded at Brahminabad, and the elegancy of the forms of many of the domestic vessels seems to have been borrowed from the Greeks—Mr Bellasis has discovered a multitude of beautiful carvings in cornelian and ivory and glass enamels—and singularly enough the art of dyeing the Onyx by boiling in oil and then heating, as at present practiced in Germany, seems a thousand year ago to have been known in Sinde, though it has long been lost in India. Fragments of inlaid work, similar to that for which Bombay is famous, have also been discovered, and sets of ivory ches-men were found in abundance, almost exactly the same as those now in use. Sir William Jones points out the probability of the game having been known at a very early age in Hindostan—we have no indication of the date, and the proof of the fact is chiefly based on tradition and Sanscrit analogies. We are now no longer left in doubt about the matter, and chess was obviously a very common game in Sinde at the time of the Saxon Heptarchy when Europe was in its deepest state of darkness. Mr. Bellasis has pursued his inquiries with an ability and energy proportioned to their importance, and in all likelihood opened a vein which, if fittingly worked out, may add a most invaluable chapter to the early history of the western border of Hindostan. We see no reason to despair of this in some measure connecting the Greek and Mahomedan invasions, the long interval between the two having hitherto remained nearly a blank in our annals. Already a very

important fact as it appears has been made out in Meteorology, and the case is one where we may probably expect to find the field of the Antiquary overlapping that of the Geologist. Some singular change indeed must have come around on the surface of the country before the channel of the Indus could have been thrown fifty miles to the westward of its ancient course; and it is quite clear that populous cities could never have been built or flourished on a barren waterless waste such as that on which their remains are now found to prevail.—*General Woodburn.—Bombay Times, March,* 1856.

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# APPENDIX C.

## BOTANY.

There is at present growing near Sewree a specimen of that beautiful tree, the "Bengal" or "Royal Goldmohur"* (Poinceana elata) as it is called, which affords us one of the most striking examples we have met with of rapid growth. The seed which produced it, was gathered in 1848, and the sapling when about six inches long and an inch in girth planted out on Waterloo Day (18th June) that year. It now measures four feet above the ground, three feet four inches in girth, being thus above thirteen inches in diameter. The bole is eight feet in height, and the spread of the branches nearly fifty feet.—*Bombay Times, September,* 1854—*Dr. Buist.*

Our mention of the rapidity of growth of a "Goldmohur" tree (Poinceana elata) has been capped to-day by an account of the wonderful productiveness of a mango. "There is," says our informant, "a fine healthy mango tree in Mrs Hough's garden, about ten years old, which for the past eighteen months has afforded fruit nearly all the year round. It yielded a good crop in May 1853, a second in July, and a third in December, the two latter of course being much less abundant than the former. In May 1854 it once more gave an ample crop, it yielded a lesser one in July, in the very heaviest of our rains, and it is now once more in flower. Productiveness of this sort may be all very delightful for the garden, but it would be rather inconvenient for the *Nursery.*"—*Bombay Times—Dr. Buist.*

The observer in natural history will derive no small pleasure at present from visiting our various tanks, to see how beautifully nature carries on her operations. When the Framjee Cowasjee tank was cleared out and deepened in 1850, a vast mass of the cemented shells and gravel called Littoral-concrete was taken from it, the bottom being lowered as much as circumstances would permit. The rains came before the operation was finally completed, and the bottom was thus left grooved into canals with masses of rock between. At present the water, about 20 feet above these, is as transparent as the brightest crystal, and occupied here and there by vast floating masses of the soft pulpy plant called the *Serpicula verticillata*, which has the invaluable faculty of maintaining the tank or pond in which it lives in the most perfect purity—insomuch that a jug or tub may be kept pure for an indefinite length of time, merely by containing a few sprigs of the plant. In looking into the tank a magnificent marine landscape presents itself, with snow white rocks and valleys, and rich green miniature forests in all directions. Fishes are seen in abundance everywhere, and a few small bright-eyed frogs skimming the surface complete the picture; looking up at the spectator just before they plunge in, as if to say, catch me if you can. Water thus pure is nearly devoid of insects, even of the

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* The Goldmohurs here mentioned were stripped of nearly all their branches by the hurricane of November 1854, and refused to flower for the season. That which measured 3 f 4 in. in September 1854 increased to 3 f. 8 in. by April 1855, notwithstanding the ill usage experienced by it.

larvæ of the mosquitoe, discoverable almost everywhere besides. On examining the other tanks on the island, the brightness of the water we have always found dependent on the abundance and purity of lime at the bottom on the healthiness of the *Serpicula*.—*Bombay Times*, 18*th December* 1854.—*Dr. Buist.*

Wonderful little plant! What economy of nature, what harmony of design, what striking phenomena, what instinctive apprehension almost, is exhibited by this tiny humble tenant of the lake! Would we wish for a process to render wholesome water, one of the elements most essential to man's existence,—the little *Serpicula* supplies it. Would we desire to provide food for the other scavengers of the tank, the Shell-fish,—the little *Serpicula*, with its leaves and stems pregnant with starch-granules, affords them a delicious repast— they browse with greediness on its tender shoots. Would we wish to witness one of the most striking phenomena in the vegetable creation, the circulation within the vegetable cell—the little *Serpicula* presents a vivid instance of it. Lastly, would we seek an example of economy among plants almost approaching to instinct,—let us follow the process of impregnation in the little *Serpicula*. What are these little flocculent particles on the water too small to be distinguished by the naked eye?—these are the stamens of the *Serpicula*. Bound to the bottom by its roots, with its pistils and stamens in separate flowers, this little monœcious plant labours under unsurmountable difficulties in bringing them together under water. But mark how beautifully has nature met these disadvantages. Look at these tiny flocculent particles again through the microscope; they are composed of three small heart-shaped bodies of a violet color, supported on short slender stalks which diverge from the centre of a diadem formed of three minute white leaves turned downwards. Seated thus above the water, they drift about whereever the wind lists them. Observe that gentle little flower stretching itself up from the dark bottom on its slender pedicel to spread its pink petals on the surface of the water, to the air and light. That is the female flower of the *Serpicula* after the truant anthers; and here the latter are all assembled round her; the violet sacs pending over her and dropping the pearly, pollen globules into her greedy cup. Wait but an instant, and the pink of youth and beauty fade, the slender pedicel becomes too weak to support its dying petals, and the diadem and its little superstructure sink to the level of the water: the lustre of sparkling life has left the actors: the scene is closed for ever and the curtain drops. But the pollen globule has gone down to the hypogonous seed below, to that mysterious rest which precedes the resurrection of the new plant another year, and thus the reproduction of the little *Serpicula verticillata* is unerringly perpetuated.—*Bombay Times*, 1855.—*Dr. Carter*.

The specimen of *Nostoc*, mentioned in the presents to the Museum, which very much resembles *N. Collinun Kg.*, was sent to Mr. Frere, by Lieut. Cowper, acting Collector Shikarpoor,* with the following note :—

"I send you herewith a small specimen of a substance said to have fallen last month in Boondika, just a little beyond the Bigaree canal. The weather was showery at the time, and the substance was pretty thickly strewed over a space of 2 or 3 miles square. The Natives described it as a shower of gosht (meat), which they said it resembled, being, when fresh, of a soft pulpy consistence and like flesh in color."

The Secretary, Dr. Carter, stated that this substance now consisting of dry and shapeless fragments would, after having been placed in water for a few hours, resume its natural gelatinous form, and thus reveal its true character. It was an Alga called *Nostoc*, not far removed in the vegetable kingdom from the sea-weeds which are frequently boiled down into a jelly for food, and in China, as well as in some other countries, certain species of *Nostoc* were commonly eaten. The Scindians were, therefore, not far wrong in calling it *gosht* or meat; and from the

* Shikarpoor is 400 miles from the nearest sea.

inconceivable smallness of the germs from which it is first generated, like the green which makes its appearance over objects that have never been exposed to the monsoon, yet present this color a few days after it has commenced, the germs of this Nostoc might have been brought through the air to the place where they at the appointed time for their germination passed into visible forms, which having no earthly origin that the ignorant Scindians could conceive, and coming into tangible masses just after a storm, not unnaturally led to the conclusion that they must have been showered down from the heavens. Happily many of these events which appeared miraculous to the ignorant for some wise purpose, and give rise to scepticism among many at the present day, because they are not understood, derive explanations from science which defy all attempt at disbelief. It was wonderful to the Scindian to see what he could only conceive to be a substance rained from heaven; it is not less wonderful to the Naturalist, who can trace this substance to its germs, to wonder even still more how the first germs was generated, which uninterruptedly and unerringly goes on producing its like. Thus does the Creator keep up his power of eliciting wonder and admiration from the most ignorant to the most learned.—*Bombay Times, April 7*, 1856.

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# APPENDIX D.

## ZOOLOGY.

A Guinea-worm of full growth will live several hours after extraction, if kept in a moist state, and the young will live until the parent begins to decompose. The adult guinea-worm is, therefore, much more tenacious of life than the young ones. The head, and half the anterior part of the body of an old animal, may have dried up outside the wound for several days, while the other part, with the young, still remains living. This shows that its nutrition and vitality are kept up by imbibition through the surface of the body, while the atrophied appearance of the alimentary canal indicates that it also is very little used, and the shreds on the surface of the integument, that the animal has a direct union with the cellular tissue of the human body.—*Transactions of the Medical and Physical Society.—Dr. Carter.*

Sponges—*Animality.*—As to the animality of the Freshwater Sponge, I think there can be no doubt whatever. Look, for instance, at a ragged portion of it, torn off with a needle, (under a magnifying glass of one-tenth of an inch focus,) and it will be seen gradually to assume a spheroidal form; and, if there be a spiculum near, it will embrace it within its substance, it may be seen even to approach it, and as it were spit itself upon it; still watch it, and it may bear away the spiculum; and then, regard its circumference, and on it will be observed little papillæ, which gradually vary their form, extending and retracting themselves, until one of them may be seen to detach itself from the parent mass and go off to another object. This little animal, one of the group which it has left, may remain stationary on the second object, or descend to the watch glass, assuming in its progress all forms that can be imagined, spheroidal or polygonal; while every point of its body appears capable of extending itself into a tubular attenuated prolongation. When dead and dry on the watch-glass, it is sometimes transparent, sometimes filled or surrounded by granular bodies, and though frequently irregular in shape, its natural form appears to approach nearest to that of a Florence flask, sometimes more sometimes less globular; it is then (though its size varies with its age) about the one-thousandth part of an inch in diameter, not including the elongated portion, which in length is about one quarter of the diameter of the body, and apparently corrugated like the neck of the entozoon *Cysticircus longicollis.* These transparent little sacs (the gemules of Grant and Hogg?) are sometimes filled with green matter. They appear to be able to adapt themselves to any form that may be convenient for them to assume, and when forcibly separated from each other

(by tearing to pieces a minute portion of the Sponge under water in a watch-glass,) the isolated individuals, may be seen to approach each other, and to apply themselves together in twos and threes &c, and so on, until, from a particle only discernible by the microscope, they assume the form of an aggregate visible to the naked eye, and such a portion, growing and multiplying, might ultimately reach the size of the largest masses adhering to the sides of the tanks at Bombay. They appear to belong to the genus *Amœba* of Ehrenberg. Dujardin has recognized them, and they are correctly figured (as they appear under a lens of one-tenth of an inch focus) in Johnston's British Sponges, p. 61;—as well as certain filaments, which the day after a piece of Sponge has been treated in the way which I have just mentioned, may be seen extended from them, terminating or not in little transparent bulbs; floating, or fixed by their extremities, branching irregularly, long or short, each branch terminating or not in a bulb, and presenting similar pedicellated bulbs here and there in its course; when fixed on the watch-glass, disposed irregularly in straight lines intersecting each other,—radiating from a common centre or bulb, or in the form of an areolar membrane; frequently moniliform, as if they grew by the addition of cells to their free extremities.

The aggregated position of the animals I have described, imbedded in the transparent tissue of the sponge, bears a great resemblance to that of some of the Compound Tunicated Animals; especially in their ultimate development into a mass, intersected in all directions by canals, to allow of the presence of that element, which is necessary for their existence,—the freedom they possess in the early part of their life, of moving through the water or creeping over the surfaces of solid bodies, and their ultimate destination of becoming permanently fixed in a granulo-gelatinous mass, secreted or formed by themselves.

There is also a curious fact connected with the vitality of the Freshwater Sponges, and I think it also prevails with the Sea Sponges, for it was by observing the latter and their seed-like bodies, in the amorphous species, that I was first led to notice it.

It is, that they may be taken out of their natural element, dried, and kept for months, without losing their vitality. This I have inferred, from observing the Sponges attached to the rocks on the upper parts of the tanks, which are uncovered for many months of the year, (indeed the greater part of it,) to be now again in the full performance of all their vital functions. I have not yet been able to prove it entirely to my satisfaction by direct experiment, but, on the sides of a finger-glass in which I placed an old dried portion of *No.* 1, about a month since, changing the water daily, there are now growing, atoms of new sponge visible to the naked eye, and there are large portions of the original mass adhering to other objects in the same vessel; but I have not yet been able to satisfy myself of the presence of new tissue in the latter.

A Porcupine's Mode of Defence.—The following, from a sporting friend in the interior, will be of interest to brethren of the chase, as going far to re-establish the old belief that the Porcupine possesses the power of dashing its quills, when enraged, at an assailant:—"It was commonly believed, not very many years ago, that porcupines could throw their quills so as to mortally wound at several yards' distance, but now the idea is scouted by all naturalists. However, a circumstance occurred lately which has rather puzzled one as to whether they have the power or not—and as at all events it may afford a point of discussion to those curious in such matters, I extract the following from my shikar book, for insertion in the *U. S. G.* At C* * *, on the morning of the 5th of June last, I received intelligence that a Tigress had just been seen going into some large rocks in the bed of a river about three miles from the bungalow. Having no elephant, I proceeded down and took post in a tree, where it was supposed the tigress would break, and I sent the beaters to the opposite side to drive her towards me. They had not been long at work when she commenced growling, and, finding from the sound that she was not full grown, I got down and took up a position on a large rock, fronting the one from which she growled; *but to make a long story short*, she broke, and was shot in the lower part of the stomach, and in the hind

leg, notwithstanding which she managed to get into another cave, with a part of her intestines dragging along the ground. I then set to work with fire to burn or smoke her out, and after some time she again broke, and lay down between two rocks close to me, when I gave her the 'coup de grace.' On pulling her out I found she was a young cub, about a year old, and (now for the curious part of the story) had three porcupine quills, at about two inches apart, driven deeply into her, one sewing up her right eye, and two in her neck There is no doubt that a porcupine was in the cave with her, as some of the beaters saw one go in a short time before. So this will do away with the supposition that they were loose quills, which the cub had stuck in herself in rolling about. Then, on the other hand, if the cub in her agony had rushed against the porcupine, how could three quills have only entered, and those too at some inches apart"

SOCIAL SPIDERS.—"It is a common opinion, upheld by high authority, that the family of Araichneids are unexceptionally solitary insects, never existing in communities, and so fierce in character, that the female frequently destroys the male. Azzare, the great and ardent naturalist, holds, however, a different theory grounded on experience, and late personal observation has put us into a position, to confirm his assertion."

"Now our experience proves at all events that whether or not the social spider exists in Paraguay, it is certainly found in Bengal. We collected a number of these insects; their colour darkish grey and striped down the back with white. We placed them in an inverted wall shade. They *immediately began to form a large and substantial nest; the top was so constructed as to oppose all intrusion* and form a shelter just as Azzare relates. All the business went on from under this, the threads extending downwards and winding about. Every morning we remarked an increase in the size of the domicile, proving that the labourers worked at night, and the whole community lived apparently in perfect harmony and quiet. A blue bottle fly put into the shade was, of course, a great attraction and a signal for a concourse of candidates all running down the threads like *a ship's crew down the ratlings of a ship.*—*Bengal Hurkaru, April 10.*

[The nests of social spiders are to be found on almost every tree in Bombay. The Boora (Zisiphus Lotus or Jeejub) is the favourite, and servants cut off branches containing webs, and hang them up in the cook-room, where the spiders entrap and destroy the flies.]

LINNEAN SOCIETY.—June 20, being the last meeting for the session, Professor Bell, president, in the chair.

The secretary, who read a letter from Dr. George Buist, containing an interesting account from personal observation of the mason wasp of India The male of this insect is about twice the size of the common wasp, and of nearly the same colour, the slender portion, which connects the abdomen with the thorax, being nearly one-eighth of an inch in length, and scarcely thicker than a horse hair. The female bears no resemblance to the male, being about one-eighth of his size, and of a bright shining bottle green. Early in October, as soon as the rains are fairly over, the male mason wasp begins to build. Selecting for his nest a spot in some quiet corner, he approaches, holding in his fore feet a piece of wet mud, about the size of a pea. He first makes a neat thin ring of about an inch in diameter. To this successive additions are made till the edifice assumes a nearly spherical form. The opening at the top is now contracted like the neck of a bottle, and turned over with a flat lip, an opening being left of about one-eighth of an inch in diameter. Two or three of these little structures, each taking six or eight hours to finish, are usually built together, and left to dry. So soon as they are firm enough the female is seen flitting about and dropping a few ovules in each, and these he attaches to the side of the chamber. The male now approaches, bearing a large green caterpillar, about three quarters of an inch in length, and fully as large as himself. This, in spite of its struggles, is at length thrust through the bottle-neck aperture of the nest, by the inexorable bee, the utmost care is taken that these should be injured as little as possible, so that they may live till the incribation of the oval has taken place,

and the larva is liberated. The latter then in the shape of maggot feed on the caterpillars, until it is sufficiently fattened to pass into the pupa or chrysalis state. A brown horny case is then secreted around it, from which the pupa afterwards separates itself, and gradually becoming metamorphosed passes into the full developed animal or imago condition. The orifice is then closed with a little ball of mud; more bottles in succession, to the number of eight or ten, are built, provisioned, and sealed up in the same way, and the builder then seems to trouble himself no further about them. Dr. Buist, who has frequently watched these operations at Bombay, has never happened to see the grubs or young bees, but he states that about a fortnight after the nests are finished they are all found to be burst through, when the fragments of the shell and casing of the chrysalis are seen inside.—*Transactions of the Linean Society, extracted by Dr. Carter.*

# APPENDIX E.

## MISCELLANEOUS.

Possessed of Evil Spirits.—The worst kind of charlatanism cannot do so much harm as that species of imposture called *bhoot* or *dei*, which means witchcraft, or the black art. By the Hindoos, and a portion of the Christians also, every ailment is referred to the influence of somebody, through one of the Bhagats or professors of the black art; and an unsuspected Bhagat is consulted, who encourages the belief (as he is to profit by so doing), and is often prevailed on, and has the indiscretion, to point out some rival Bhagat, and some enemy of his client (having in the meantime inquired about all persons that are likely to bear an ill-will against him), as the offending parties; himself offering to neutralize the efforts of the other Bhagat. Not to speak of the extortions, of the enmities, and of the murders this is the source of, his promises to effect this last lead to the neglect of legitimate advice and treatment, until the sufferer either recovers or dies, or the disease is rooted in him. If the issue of the case is favourable, he gets the credit of it; if otherwise, he finds some pretext to extricate himself from his position; such for instance, as having found out that the case (in its last stages) is amenable to medical treatment. This evil appears only to be remediable by an enactment imposing a heavy penalty on those proved to exercise the art, as also some punishment on those having recourse to them."—*Dr. Gomes' Account of Medical Practice in Salsette.—Bombay Government Papers.*

Bottle Logs.—1. A bottle thrown overboard from the steamer *Singapore* at noon on the 20th October 1852, in Lat. 6° 46′ N., Long. 79° 37′ E., was picked up at Caltura, Ceylon, 16 miles south of Colombo, at 7 A. M. on the 24th October. Colombo is in Lat 6° 55′ N., Long. 79° 50′ E., and the bottle had thus drifted in four days a distance of about seventy miles south easterly, or at the rate of eight miles a day. It is not stated whether the bottle was found on shore or at sea, so it may have occupied less time than this on its journey. From this and from the four-fifths of our bottle logs quoted below, it would seem that there is occasionally a drift direct inshore on both sides of the southern portion of the peninsula.

2. An extract from a bottle log thrown overboard from the ship *Precursor*, on her way from Calcutta to Suez, at noon on the 21st of August 1853, Lat. 4° 30′ N., Long. 70° 15′ E., during a fresh blowing monsoon with squalls, was picked up at sea betwixt Pulo Lancava, in Lat. 6° 8′ N., Long. 99° 50′ E., and Pulo Bidan, in Lat. 5° 35, and about Long. 100° 21′ E., close to the entrance of Penang, at ten o'clock on the morning of the 15th October last. The bottle had thus been fourteen months, or four hundred and ten days at sea, during which time it had swept over nearly fifteen hundred miles of space, almost exactly from W. to E. This would give us a current of about three miles and a half a day almost directly in

the teeth of the trade wind, or probably of above four miles, making allowance for the obstruction sustained by this.

3 The Secretary of the Geographical Society received through the kindness of the Vice Admiral and Commander-in-Chief of the Royal Dutch Navy in the East Indies, a bottle log, of which the following is a copy. The log is marked 101, and as the *Ganges* was only provided with them some ten months before, she must have thrown one overboard almost every day she had been at sea. We have another of later date marked 146, which shews that Captain Baker is remitting nothing in his exertions, and that he is duly seconded by his brother officers, as shown by the fact that of the three logs received from him, two have been picked up at sea :—

"This bottle was thrown from on board the P. and O. Steam Ship *Ganges*, on her way from Singapore to Hongkong, at noon, on the 19th day of October 1853. Lat. 6° 21′ N., Long. 187° 19′ E., course N. E. 5 E., 202 miles ; current S , 18 W., 14 miles. It was picked up at the Isle Great Bastard, North Coast of the Isle Flores, in Lat. 8° 24′ S , and Long. 122° 24′ E, on 16th of February 1854, by a native of Galitung, and received on board H. M. Netherland Steamer *Etna*, on the 10th September 1854, by Lieutenant H. F. Valentine."

This bottle had thus travelled over twenty degrees of longitude and fourteen of latitude, or a distance of about 1,800 miles in all, in the space of 114 days ; the log No. 2, noticed above, 1,500 miles in about 400 days. This indicates a current from the mouth of the Straits of Malacca S. E. and by E. betwixt Java and Borneo of about fifteen miles a day. The next log we come to is that thrown overboard by the *Ganges* on the 16th March 1854, in Lat. 5° 38′ N. and Long. 100° 6′ E. ; it was picked up by the *Penang* at 7 A. M. on the 18th of the same month, inside of Palo Televose Island north channel, having travelled S. Easterly, a distance of sixty miles in 43 hours. The log we come to after this was thrown from the *Singapore* on the 21st of March 1853, Lat. 6° 13′ N., Long. 96° 37′ E., and it was picked up by a native at Quellah Yen Quedah in June 1853. This place is 24 miles, northward from Penang, in Lat. 6° N., and Long. 101° E , or it had therefore travelled betwixt 250 and 300 miles nearly due E. in, we shall say, three months—for the day on which it was found is not mentioned,—neither is it stated whether it was picked up at sea or on shore. Speaking by guess it probably had travelled at the rate of about three miles a day, or pretty much at the same speed, from Ceylon to the point where this takes the survey. The four logs amongst them luckily give us an uninterrupted track from Lat. 4° 30′ N. and Long 70° 15′ E. to Lat 8° S. and Long. 122° E., or over a space of about 3,500 miles, in which we find a continuous current for the first half of its course from W. to E , flowing at the rate of about three miles a day—for the second from W. to S. E. by E., flowing at the rate of about ten miles. We have not as yet the means of knowing whether this equally obtains during both monsoons, but from all that we can observe, it would seem that here the currents of the ocean are very unexpectedly opposed to the general direction of the wind.

4. Another bottle log thrown from the P. and O. Steamer *Cadiz* on the 1st of July 1854, in Lat. 5° 37′ N., Long. 82° 29′ E , was picked up on the sea coast at Nagore, near Negapatam, Bay of Bengal, on the 12th April. Captain Roberts, who threw it overboard, remarks that a slight current was running at the time towards the south, with a fresh monsoon blowing from the west—Temperature of the sea 86—Density 10. The place where this bottle seems to have been picked up is in Lat. 10° N., Long. 80° E., or thereabouts ; and the course it appears to have pursued is a singular one, having travelled 2·29 westward and 6·23 northward, against a current apparently southerly. The conclusion to which this leads is much less decisive and distinct than that afforded by bottle logs previously picked up, and it looks as if it had been following much more the course of the wind than of the sea. The distance travelled by the bottle is betwixt four and five hundred miles, traversed in not more than one hundred and seventy-two

days, although upon this point again we are uncertain, as the bottle was found stranded, and may have lain some time on the beach without being observed.

5. The *Friend of India* mentions a bottle log which had been picked up on the Tavoy Coast, on the 7th August in 1855, in Lat. 9° N., Long. 98° 5′ E.—it had been thrown overboard from the P. and O. Co.'s steamer *Singapore*, by Captain Baker, in his voyage from Bombay to China, in Lat. 5° 59′ N., Long. 89° 16′ E., on the 13th of April. It had thus travelled 3.1, that is 190 miles N., and 8.50, that is 530 miles E., or probably a distance of about 650 miles in all. This was accomplished in 116 days, or at the rate of five and a half miles a day.

6. We have been favored by the Colonial Secretary, Ceylon, with copy of a bottle log thrown overboard from the Steamer *Erin*, on her way from Bombay to Aden, on the 4th of May 1855, in Latitude 16° 44′ N., Longitude 65° 03′ E. It was picked up at sea at noon on the 20th of August, ten miles west of Colombo Light-house, consequently 6.58 N. and 79 44 E., it had thus travelled about a thousand miles nearly S. W. in the course of one hundred and eight days, or at the rate of about ten miles a day.

7. A bottle log was picked up on the 22nd of May, two miles east of the village of Sootree on the Coast of Cutch, Latitude 23° 30′ N., Longitude 69° E.—"Thrown overboard from the H. C Steam Frigate *Semiramis*, May 11th, 1855, in Latitude 23° 48′ North, Longitude 65° 50′ East." It had consequently travelled in eleven days about two miles south, and two hundred east, indicating a current of nearly twenty miles a day. This is the first bottle log we have received from any part of the Arabian Sea, the four or five that carried us round from Ceylon to the far southern latitudes indicated currents of from two and a half to three and a half miles a day. In thick heavy weather, when there is nothing but dead reckoning to resort to, an indrift of the fearful amount of twenty miles a-day might get a coasting vessel ashore on Cutch or Kattiwar when she had no idea of danger.

Sambur Salt Lake, Rajpootana.—The lake is some 20 miles long by five miles broad. At no part of it is the depth great—indeed, as the natives informed me, were it not for the mud at its bottom, it might be considered every where fordable. I was told that three streams are its principal feeders. It has no outlet for the escape of overplus water—all is carried off by evaporation. At the time I paid my visit the lake was nearly full, it being soon after the monsoon. The water was not then very salt. As the salt with which it is impregnated is supposed to be drawn from some immensely large natural deposit below its waters, the impregnation is gradual, so that perhaps the powers of solution are not exhausted before the month of March. Then a powerful sun, a high temperature, and steady strong breezes cause rapid evaporation. The extent of surface covered by water quickly decreases, and the water itself assumes a reddish or purple hue—in fact it becomes brine—or as the natives term it "pukkaos" or ripens. As must be evident the process of desiccation causes the deposit of salt. The red colour is due to the presence of the animalcule of the valvax race. On the mud an incrustation some three inches thick is formed. This is then collected at different fixed places of deposit above *high water mark* on the shores of the Lake, or Samund as it is locally called. The heaps are coniform, and not protected by any roofing. On making an observation to the persons in charge that rain must melt the salt without some such protection, they informed me no such injury was caused, because the surface being softened by the action of the first fall of rain, it afterwards formed a hard crust fully equal to its future perfect protection. This crust I observed was a good inch thick, and was very hard indeed. It reminded me of the appearance and substance which snow assumes that while rapidly thawing is suddenly congealed by a hard frost. These deposits of salt supply the consumption of the country around, besides sending large quantities into the provinces of Hindostan. While I was there not only were numerous camels being loaded, but also innumerable Brinjaree bullocks, most of the latter from Bhurtpore, and I think Agra—the camels generally coming from Jeypoor. I am not aware

that any analysis of the salt, or of the lake water, has been made. Lake Sawmur is situated partly within the Jeypoor and partly in the Jodepoor dominions, and by an understanding between the two Governments its produce of salt is sold under the control of a Wukeel from each Durbar, who each holds his cutcherry in the town of Sawmur, which has evidently at one time been a far more considerable place than it now is. It has a-seen-better-days sort of look about it, and the tumuli and ruins around bespeak its reduction in size. The share of the Jeypoor State is more than one-half of the whole proceeds, possibly from a greater proportion of the Samund being embraced by its territory, but I know not the true reason for the inequality in the dividends. The whole yearly income I was told varies from four to six lakhs of rupees. This year the lake has been more than usually full of water, which would, as I supposed, have likely caused a greater produce of salt; but this did not appear to be expected by the Natives, though I did not hear any good reason assigned by them. I am not certain, but I think they preferred a medium amount of water in the lake, and if so I conclude that in such a case the dissolving of the salt and the evaporating power were more equalized and made the produce greater. I was led to expect that large crystals of salt of a pretty appearance, and many of them worked into different shapes, would have been brought for sale. I saw nothing of the kind, and forgot to inquire about them. The lake has completely the appearance of that on the Flats between Mahaluxumee and Worlee and might pass muster for it. I have not heard it remarked by those, who till they came here had been accustomed to sea salt, that they found that of Lake Sambur in any respects different for common use. I was much struck with a very simple but ingenious way by which the salt deposition or manufacture was forced or hastened. At a little distance from the banks—say 200 or 300 yards—where the water is I dare say some two feet deep, a very considerable enclosure or coffer-dam is made by means of posts interwoven with twigs or reeds which are made water tight. The water, by the use of scoops kept swinging by manual labour, is baled-out till only a sufficient moisture is left that can be carried off by the reduced temperature of the sun's rays in the cold season, and the residue is then collected. An offer was made to take me off on a raft of reeds to see one of these, but time did not admit of my going, besides I was told I must expect both to get wetted and also covered with mud, so the temptation to go did not overcome these objections. I imagine these coffer-dams were in diameter about 150 yards, and there were several of these at Sawmur. This town by the bye, is at the east end of the Samund, and the intermediate neighbourhood is not hilly. There are isolated short chains of hills retired from the lake at that end of it, but the country generally is a plain shelving for very many miles back gradually towards the lake. The downward inclination is however so gentle as hardly to be perceptible in riding over the ground. The incline is, I have no doubt, much the same under the waters, and will account for their shallowness. For some miles west of Sawmur, the same description holds good, these hills rise more abruptly over the Lake, round part of the south, the whole of the west and part of the north side. In short, hold a coal skuttle with the point slightly elevated and some sort of an approach to the appearance of Lake Sambur, its basin and banks will be produced, barring however the regularity of the sides of the useful article borrowed for the nonce as a simile, those of the lake being irregular. Having by me the letter of a friend, learned in natural history and geology, in which he gives me a description of the N. W. approach to and appearance of the Lake (which I myself did not visit), I gladly take advantage of it, both because of its graphic and its scientific detail:—'From Mukhranait is a good march of seven hours to Awoo, near the lake. The lake is situated about 250 to 200 feet deeper than the valleys in the principal chain of the Aravullis, and you descend a steep pass, from the top of which you see the lake extending below you. Awoo is a small village, where you hardly can get supplies. The lake itself is only a pool of water, large after the rains, and drying up almost entirely during the hot season, when the people of Sambur take away the white crust of salt which it

left behind. This explains the absence of fish in the water. Although devoid of large animals, the water full of a small animal of the Class Crustacene, which serves as food to an innumerable swarm of birds of many kinds—you see them lining the water as far as the eye reaches and pickng the animals. Their lines (they marched up like regiments, each kind together) extend almost in to the middle of the lake, the water being very shallow. The lake has no depth, the deepest places being easily fordable, and no banks ; between the water and the dry ground is a region of mud gradually sloping towards the lake. From Awoo to Sambur is eight hours' march. I believe that the salt has been soaked out of the ground every rainy season, since the Aravullis have been raised, and collected in the deepest spot which happened to be where the lake is. It is of the same origin as the salt near Nusseerabad, and the salt which is washed out of the ground in the whole region between the Dumnce river and the Aravullis. It seems to have remained after the water of the sea, which formerly covered these parts, had been evaporated or run off.' In regard to tho birds remarked on in the above extract, I must observe that during my visit I never in my life saw so many ducks and teal as were then on the lake. Of a morning the water was a continued series of black dots, and in riding for miles along the bank, as those behind disappeared from the eyesight, fresh numbers come into view ahead ; flamingoes were very numerous, and also many waders. The marble quarries which have for ages, further back I believe than can be traced, supplied all India with the white marble known as that of Mekrana, (the village nearest to the quarries,) is twenty miles west of the Sambur Lake and some fifty miles N. W. from here, and is worthy of being paid a visit by the curious enquirer.—*General Woodburn*.—*Bombay Times*, 8 January, 1856—For more minute particulars of, see the proceedings of the *Bengal Asiatic Society*, 1836, vol. v., p. 804., Statistical Papers, Blue Book, 1853.

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